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# Field Museum of Natural History Bulletin

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**Field Museum of Natural History Bulletin**

January, 1979
Vol. 50, No. 1

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COVER

*Lake Michigan and the Indiana Dunes. Photo by John Kolar.*

# FIELD BRIEFS

### Scanning Electron Microscope Adult Education Course

The SEM course will again be offered this spring, beginning March 20. The course will meet once a week for five weeks, each session lasting from 7:00 to 9:00 p.m. Instructors are Alan Solem, curator of invertebrates, and Christine Niezgoda, herbarium assistant, Department of Botany. Course fee is $60.00. Enrollment is limited to 24 persons.

Information on dates and registration may be obtained by calling 922-9410, X-382, or by writing: Adult Courses: SEM; Dept. of Education, Field Museum of Natural History, Roosevelt Rd. at Lake Shore Drive, Chicago, Ill. 60605.

### The Place for Wonder: Opportunities for Volunteers

The Department of Education announces that volunteer opportunities are now available in the Place for Wonder, Field Museum's ground floor gallery where natural history specimens may be examined first hand by visitors both young and old. Place for Wonder volunteers will participate in a unique teaching situation that utilizes the hands-on and inquiry method approach to education. Who may serve as a volunteer? Persons with one day a week to share, who enjoy working with children and families, and want responsibility are invited to call Vicki Grigelaitis, the volunteer coordinator, at 922-9410, ext. 360.

### CORRECTION

In the article "Solem and Snails" by Patricia Williams, which appeared in the November, 1978, *Bulletin*, an incorrect number of pages was given for the monograph *Endodontoid Land Snails from Pacific Islands (Mollusca: Pulmonata: Sigmurethra), Part I, Family Endodontidae*, by Alan Solem (Field Museum Press, 1976). The correct number of pages is 508.

### Loren Woods Retires

Loren P. Woods, curator of fishes, has recently retired after more than 40 years of service to Field Museum. Woods first came to the Museum in 1938 as a staff member of the James Nelson and Anna Louise Raymond Foundation (now part of the Department of Education). He was assistant curator of fishes from 1941 to 1947 and was then appointed curator.

Over the years he has participated in expeditions to the Indian Ocean, Western Atlantic, Southeastern Pacific, Western Caribbean, Gulf of Mexico, Surinam, Puerto Rico, Virgin Islands, Florida Keys, and to many of the states, particularly in the Midwest.

As curator emeritus, Woods is continuing his research on the beryciform and pomacentrid fishes. Associate curator of fishes Robert K. Johnson has succeeded Woods as head of the Division of Fishes.

### Borden Expedition Film

Saturday, February 3, is the day to see the exciting feature-length film, "The Cruise of the Northern Light," taken during the Borden-Field Museum 1927 Alaska Arctic Expedition. (The expedition is the subject of a two-part article concluded in this issue; see p. 4.) The 60-minute film will be shown at 1:30 p.m. in James Simpson Theatre. Admission is $3.00 for nonmembers, $1.50 for members and students with I.D.

Mrs. Rochester B. Slaughter, a member of the expedition, shot the film and it was subsequently shown at various places in the Chicago area. In 1976, the film was given to Field Museum by Mrs. George L. Simpson, of Eau Claire, Wis., niece of Mrs. Slaughter, who died in 1949.

Introducing the film on February 3 will be Mrs. Foster Adams (the former Mrs. John Borden), who accompanied the expedition. The film narrator will be expedition veteran Rev. Theodore Purcell, S.J., of Washington, D.C., who was only 15 at the outset of the expedition.

### Egypt Tour for Members

Three seats are still available on the Field Museum tour to Egypt departing Chicago February 15. The per-person all inclusive price is $2,950. (Includes a $500.00 tax-deductible donation to Field Museum.)

Join with us and visit Cairo, Beni Hassan, Ashmunein, Luxor, the Valleys of the Kings and Queens, Aswan, and much more of this fabled land. The luxury of a Nile River cruise is also in the itinerary. Write or call Michael J. Flynn, Field Museum Tours, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605 (922-9410)

*The Place for Wonder: volunteers needed* Ron Testa

*Four of the surviving Sea Scout veterans of the* Northern Light's *cruise, shown at the helm of another schooner during a 1978 reunion. Left to right: Bruce Andrews, Rev. Theodore Purcell, Ken McClelland, and Otto Carstensen. Rev. Purcell will be at Field Museum on Saturday, Feb. 3, to narrate a feature-length film on the 1927 expedition.*

# The Borden-Field Museum 1927 Alaska Arctic Expedition

## Part II

*By* TED KARAMANSKI

The first installment of the account of the Borden-Field Museum 1927 Alaska Arctic Expedition appeared in the November 1978 *Bulletin*. That segment told of preparations for the adventure, of the group's departure from San Francisco on April 21, 1927, aboard the schooner *Northern Light*, and subsequent events to July 15. At this point the vessel was in the Arctic Ocean at Cape Serdzekamen, on the northeastern coast of Siberia.

Mrs. John Borden (now Mrs. Foster Adams), wife of the expedition's sponsor and a member of the expedition, subsequently wrote a book-length account of the venture, *The Cruise of the Northern Light* (MacMillan, 1928). The following text (italics), with the author's permission, is excerpted from the book:

*July 15: All we could think of when we made out the grotesquely familiar forms was* Alice in Wonderland: *" 'The time has come' the walrus said." The tremendous ugly creatures were a shapeless mass until their heads were raised to peer around; then they jabbed one another with their tusks and a few minutes later were again asleep. The light-colored boat with its white figures probably seemed to them a cake of moving ice . . . . The great Nansen and Johansen and other explorers on their dash to the North Pole, have been attacked by these huge monsters. We cruised up in the launch and took some moving pictures as the enraged bulls neared us, somersaulting their huge bodies in and out of the water, showing us their stupid whiskered faces as they came up snorting.*

*July 16: An* umiak *is the most valuable part of an Eskimo's equipment, an efficient craft, fully equal to one of our ship's boats, and in some ways preferable. [It] is about thirty feet long and in smooth water will hold a cargo of more than two tons yet it is so lightly constructed that two men can carry it over the ice, an important feature north of Bering Strait where a boat may be hemmed in by the ice for a long period, and inability to escape means serious suffering. A whaleboat is much heavier and the slightest accident may stove it in, while the skin boat can be jammed into ice and remain uninjured. Its broken ribs need not be repaired until convenient . . . .*

*July 17: Our position was 55 miles east of Wrangel and forty-three miles south of Herald Island, 330 miles north of the Arctic Circle, and 180 miles from the Siberian shore. We were swallowed up within the Arctic whiteness of the North. The great Polar ice-pack, that relentless terror, nearly surrounded our little ship on its sweep across the Pole of Inaccessibility and a million square miles of unexplored territory . . . .*

Leaving the Siberian coast, the *Northern Light* headed eastward again, and after several days reached Pt. Hope, Alaska.

*July 23: Primitive implements of carved ivory and jade, which the Eskimos are beginning to realize are in-*

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*Ted Karamanski is a doctoral candidate in history at Loyola University.*

*teresting to white men, have recently been excavated from underneath the mounds. We made an important collection of these articles which were pressed upon us by the male population, and they are now part of a much larger collection that we presented to the Field Museum. There were ivory* labrets *formerly used by the men as chin ornaments, whaling knives, flints, and crude stones for killing birds . . . .*

*The* igloos *that the Eskimos live in today stand above ground, mere hovels of moss-covered whalebone, We called on the native mayor [of Tikeraq, a Pt. Hope Eskimo settlement] and were nauseated by the stench of seal blubber, and intestines lying in the main entrance. The center chamber was a small square box, used for sleeping and eating, into which light penetrated from [a gut-covered] aperture in the mud roof . . . . Four squaws sat on the floor, each holding a small child and anxiously watching the supper that hissed on a very modern stove. Sugar, tea, and tobacco, luxuries beyond the reach of the less fortunate Chuckchees, were in evidence . . . . The oldest woman, . . . became ecstatic over my gay colored coat, although Mrs. Slaughter was wearing a far more attractive blue parka . . . .*

*July 25: Little John [one of the Eskimo guides] joined us near the pilot-house, where we were standing enjoying the shimmering, golden sunshine, and announced, "Now Capt'n, you can come see your* kayak."

*"My* kayak?" *my husband looked a trifle puzzled.*

*I followed, and witnessed the formal and touching gift of a* kayak, *harpoon, poke, and* immamidik. *They were childishly happy in their ability to please "Cap'n"; their black eyes fairly sparkled with delight. Little John explained: "Wood in boat seven years old—skin new every two years."—And then—"You give Museum."*

*The gut coat and harpoon was given by the older and more silent John. We shook hands all round,—and nearly kissed.*

*August 1: Mr. Hine, [Field Museum's chief bird taxidermist], while waiting for us, stopped at the [Nome] hotel and made trips back into the foothills for bird specimens. [The U.S. Department of Agriculture had issued a special permit for Hine to obtain migratory and nonmigratory bird species for the Museum.] He collected fox, golden-crowned, and Savannah sparrows, an Alaskan longspur, red poll, and a golden plover, rare in that vicinity. The plover, he explained, migrates through China and India to Australia and Polynesia covering many thousand miles. The Eskimos came on board just before we sailed, seemingly delighted to be with us again.*

*August 2: We stopped at Fairway Rock, a small granite formation five or six hundred feet high, to let Mr. Hine shoot water birds. The soft colors of green, yellow, pink, and lavender were lovely rising out of a dull blue sea and as the fog came and went we had a full view of the turreted, castle-like rock. We could just see thousands of little heads above a soft green carpet, and after the first shot millions of birds flew in all directions. We there acquired murres, paroquet auklets, horned and tufted puffins, pigeon guillemots, and a glaucous-winged gull. The feathers of the tufted puffin are like silk. It was interesting to compare the many yellow vermilion, orange, and scarlet vermilions in the bird's legs and claws,—the colors still brilliant in the first hour after death. In fact, a notable change can be seen almost instantly in the flesh part of a bird as the warmth of life leaves its body. What surprised us most about the Arctic water birds is the exact similarity of coloring of male and female in auklets, murres, and guillemots . . . .*

*In Nome my husband later acquired a collection of ivory carvings, valuable to a museum of Natural History, which had been dug up by the natives themselves from an upper and two lower stratas of earth below the present settlement on Little Diomede. There were three distinct periods of civilization represented. We added this collection to the Pt. Hope articles and presented them to the Museum.*

*August 5: The next day was beautiful, thank goodness, and a glorious day in the Arctic is more wonderful than anything any of us had ever seen anywhere else in the world. We realized why explorers, such as Stefansson and Amundsen, continually return to the Frozen North and gladly undergo many hardships along with the glorious life. We had heard in Unalaska that "north of St. Lawrence Island the sun would shine." We found it to be true. Good weather in the Polar Sea meant calm waters, radiant sunsets, and the long white nights burning with sunshine, more exquisite than any hour on the blue Mediterranean or any clear white day in Switzerland. The North has a weird, intoxicating beauty which is indescribable. No one can grasp the full ecstasy of an Arctic summer night without having drunk deep of its spell . . . . A thrilling element of hovering danger followed us always. There were no harbors for hundreds of miles at a stretch and no lighthouses of a civilized coast to guide us . . . .*

*There are summers when navigation to Wrangel is impossible at any time. We of course could not take any chances on being caught in the pack north and west of Alaska, and off the Arctic coast of Siberia, or our helpless vessel would drift to a cold, unmarked grave. On the other hand if a ship is*

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*The Borden-Field Museum 1927 expedition is the subject of a feature-length film to be shown in James Simpson Theatre on Saturday, Feb. 3, at 1:30 p.m. Mrs. Foster Adams (the former Mrs. John Borden) will introduce the film, and the narrator will be Rev. Theodore Purcell, S.J., who, like Mrs. Adams, served as a member of the expedition.*

*The 60-minute film was a recent gift to the Museum by Mrs. George L. Simpson, a niece of Mrs. Rochester B. Slaughter, who was the expedition's official photographer.*

*Admission to the film is $3.00 for nonmembers, $1.50 for members and for students with I.D.*

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*caught in the ice of the European Arctic it usually drifts south into open water and freedom. The danger was so constantly with us that I began to feel that the pack was a giant octopus, thrusting its deadly tentacles in all directions. The mere word "ice" brought shivers and goose-flesh. My readers may think I overestimate this silent, white enemy and wonder why we continued—but they must remember that we were sailing in search of Museum specimens in the graveyard of the seven seas. More ships have gone to "Davy Jones' Locker" in the waters north of Bering Strait, considering the comparatively short span of years since the Bering Sea was first discovered, than on any other body of water in all the world. The great polar ice-pack, that fiend of the North, continues to take its relentless toll.*

*August 6: That night Captain Borden and a mate sighted Wrangel Island at 10:30. After a continuous watch of thirty-six hours my husband then went below, but two hours later was suddenly awakened by the engines being signalled off. Hearing much confusion on deck he dressed hurriedly and disappeared; in a few minutes I heard: "Ice ahead!" . . . Ice! Ice!—What a word!—The water was now 29° (one degree over the freezing point of salt water) . . . .*

*Climbing down from the high bed I pulled on my heaviest trousers, two sweaters, two* parkas, *and the invaluable* mukluks *over many woolen socks, and started up the steps . . . . Everyone was staring out toward land not far distant . . . . There lay Wrangel . . . .*

*Turning my head in the other direction there shone nothing but an endless sweep of ice. Out there—a thousand miles or so—challenged the North Pole. The veil that hid it from view—and continually lured ambitious, strong men to their doom—had been torn away by Peary, Amundsen, Ellsworth, and Byrd. How simple it seemed—to be able to fly from the deck of the* Northern Light*—still further north—out over that field of both solid and floating ice . . . .*

*August 11: "May we hang our flags to the shrouds?" asked Ryan. In a few minutes the Jackson Park and Columbia Yacht Club pennants fluttered, one above the other, from the turnbuckles. These little flags waved into shreds before the boys took them down, preparing to bring back in triumph "flags that had flown at Wrangel Island."*

*Mr. Hine was equally excited. His thrill lay in the prospect of bringing the first birds from this Arctic island to the Field Museum . . . . Suddenly—"We see polar bear!" cried both Eskimos in the same breath.*

*Nothing can adequately describe our feelings. "Polar bears! Polar bears!" rang over the ship . . . . Here were the wild beasts we had sailed thousands of miles to find. I believe we did not know whether to laugh or cry in our frantic excitement.*

*"Look at them!—They are just standing there," called Mrs. Slaughter . . . . Yes—there they were—two huge white bears on that gleaming streak of moving ice. We could even see them with our naked eye. Whether they saw the boat we didn't know, because bears are supposed to have poor eyesight. But their smelling powers are excellent . . . . Both animals were evidently startled . . . .*

*We went below for warmth and relaxation. Sometimes I was Caliban secretly fearing the elements, but on this night of many thrills, the dangers and the possible fate of seafarers were soon forgotten. The victrola played incessantly and we sang loudly to our favorite tunes. Strange as it may sound on reading this, while sitting snug and safe at home, we knew we were safer on the* Northern Light, *although riding out a storm, or piloting through dense fog among reefs and shoals, than we would have been crossing State and Madison Streets, Chicago . . . .*

*August 12: Wrangel Island is approximately 75 miles long and 25 wide. So far—we had been steaming along only one shore—the east. We knew from the chart that there is a good harbor on the south coast where both the* Corwin *and the* Rodgers *anchored in 1881. There also Stefansson's little colony had landed in September, 1921, and made their camp. But they each met a tragic death before August, 1923 . . . .A stark barren island—shadowed by tragedy.*

*We now sought Rodgers Harbor as the logical place for the recent Russian settlement, the probability of which we were strongly doubting as we had carefully watched for any possible trace of human life or activity . . . .*

*We were steaming nearer and nearer to the tiny group of houses we were watching so intently. Smoke poured out of only one chimney, curling lazily through the crisp, cool air up into the mountains behind . . . . We managed to stand in toward the village, about a half mile off shore. On deck lay cases of sugar, tobacco, tea, cartridges, canned goods, and other necessities of life. Also we hoped to send out for these wretched people, any radio news for the outside . . . . Three blasts of our whistle echoed shrilly against the brown mountains.*

*At first we saw no one. Except for the smoke it could have been an abandoned village. There were three small, well-built wooden houses . . . . From the center house smoke continued to rise. Huddled near these larger houses were ten or twelve much smaller dwellings . . . . Further to the right were three other houses, probably wood . . . . While we watched, hoping for some sign of human activity, a woman came to the door of the house from where we had seen smoke . . . . She stood there, it seemed to us, several minutes, but no other sign of life was noticeable . . . . We blew the whistle again,—merely a friendly salute. (If only others could imagine how terribly exciting it was to stand there—not knowing what would happen next.—My heart was in my throat most of the time.)*

*When still no other people were visible a red flag of the "Union of Soviet Socialist Republic" suddenly flung out from the flagpole behind this same house. Someone had at last admitted our arrival . . . .*

*A few minutes later quite a considerable number assembled on the beach, looking out toward the schooner . . . . We thought that they would immediately find their* umiaks *and set out toward the boat, in the way that we were visited by the Chukchees. But no—there was no boat of any description along the beach.—They made not the slightest attempt to speak with us.*

*That was a strange turn in events! These human beings, perhaps thirty or thirty-five Cossacks and Siberian natives in all, were living on a desolate, ice-bound island, not far from the very edge of the Pole of Inaccessibility. The great polar ice-pack hemmed them in on the north and west coasts, leaving them only the exceedingly slim possibility of a navigable passage opening in the drift ice near the island again the following summer—perhaps not again for two or three years. Yet,—they did not make a move to beg for any supplies we would undoubtedly be carrying . . . . Whether the Cossacks kept the natives from coming out, whether they had no boats,—whether they one and all feared us,—perhaps we may never know.*

*As anxious as we all were to climb on those shores—to be able to collect specimens of flora and fauna on that much-wrangled-over Wrangel Island—Captain Borden did not permit anyone to go ashore. We were glad enough to be safe on the yacht, in those uncertain ice-filled waters.*

*How we would have enjoyed giving food or help to those lonely, stranded inhabitants! . . . . But we reluctantly and even sorrowfully left them to continue in their desperate struggle for food and existence in that ice-bound solitude of the Frozen North . . . .*

* * *

*It was then we first realized that Eskimos are deathly afraid of a polar bear. This savage beast has meant destruction of Eskimo hunters, women, and children . . . . They would not paddle nearer to the wounded prey that was thrashing angrily in the water, much too close. Instead they wanted to back away—jumping up and down in the boat, frantically excited, trying to scare off the offending, raging animal. We stood by, hardly daring to breathe at the thrilling scene enacted before our eyes. The whaleboat,—a hunter standing in the bow,—gun raised, two frightened natives, and a plunging, furious beast.*

*August 13: Having acomplished everything and even more than we dared hope for on leaving San Francisco, our thoughts turned toward home, and the flags were hoisted. From the main mast soon floated a lovely thin streamer over a hundred feet long with thirteen stars in a row, followed by the red and white stripes. It was our Homeward Bound Pennant, following the time-honored custom of whaling ships on the Arctic after they had boiled down their fill of whale oil . . . .*

*Before reluctantly turning away from our hunters' paradise everyone came on deck to watch the lavender-tinted hills of the island, and the pink afterglow of a wonderful Arctic sunset. Over the bow hung a large round pink moon covering the white vessel in its silvery radiance. By ten o'clock we were under full sail. The sea-scouts beamed with delight and everyone forward and aft rejoiced in a splendid climax to a long successful voyage. We had cruised for four cloudless days along the shores of this thrilling Arctic island. We had been sailing for many weeks along the white upper crust at the "Top of the world." And we were the first white women ever to reach Wrangel Island. Our party was the first to see the Russian village. Anyone with a spark of romance in his or her city-bred soul could not help but feel the enchantment of that pale but glowing night. A magical lure gripped our senses. A fresh breeze blew almost caressingly, the flapping of the sails filled one with passionate ecstasy. It was a moment when one could easily appreciate a sailor's love for his ship, far greater than his desire for home. A fair wind, a fine ship and we were homeward bound!*

*Mrs. Foster Adams (the former Mrs. John Borden), author of* The Cruise of the Northern Light, *with her husband at the Prague, Czechoslovakia, airport in 1976. Mrs. Adams notes that she and her husband continue to be "inveterate travelers," adding that their recent trips have been by airliner rather than by schooner. Mrs. Adams will be at Field Museum on Saturday, Feb. 3, to introduce a film on the expedition.*

*August 16: The next morning at eight o'clock Cape Onman came in sight. A fine warm day with a light northwest breeze and smooth sea. I had noticed the crew staring through their glasses most of the day and wondered why, then decided to ask my husband.*

*"We are searching for a lost Hudson Bay steamer that was abandond two years ago and has been reported to have drifted south near Kolyuchin Island two different times," was my answer.*

*This was certainly blood-curdling! And here is the story:*

*The* Lady Kindersleys, *insured for three hundred and fifty thousand dollars, was crushed in the pack and abandoned August 31, 1924, about 34 miles northwest of Pt. Barrow. Everything had been all right until her engines broke down. While the men worked on the engines, the ice closed in. They hurriedly wired the* Boxer, *the Board of Education boat, but she was unable to get any nearer than five miles on account of the solid ice-field. The men left the trading steamer almost immediately to escape with their lives, taking nothing with them but the clothes on their backs and managed to get over the five miles of ice where the* Boxer *picked them up. A vessel with a valuable cargo, and one insured for a heavy amount, now started on its helpless drift, not sinking immediately as was expected.*

*In 1925 natives from Cape Onman and Kolyuchin Island reported seeing a stranded ship, caught in pack-ice, and drifting off Cape Jinretlin.*

*In 1926 the same ghostlike apparition appeared again, this time inside Kolyuchin Island.*

*The steamer had evidently missed the northwest current, and like the* Vigilant *was caught in the drift that circles south off the Siberian shore. It probably went north in the winter, and again south the following summer. The drift that the ship followed is of course, only problematical. A Russian in Nome informed [the Coast Guard] that he had visited among Chukchees who had served him butter packed in tin cases marked* Lady Kindersleys. *Whether the natives and Russians succeeded in stripping the deserted, crumbling vessel, or whether she sank—no one knows.*

*August 24: At 4 P.M. we were lying to, off the southwest side of Bogoslof Island in water too deep to anchor, sixty-five fathoms less than four hundred yards from the beach. We went ashore, the crew following in two separate watches. In the launch we were surrounded by hundreds of sea lions. Two persevering large bulls swam under us, a strange sensation. We had good opportunities for moving pictures and snapshots as the beasts came nearer and nearer. Here, in 1916 my husband had much the same experience: he was literally attacked by an angry herd of these huge monsters. The men in the boat were at first frightened but soon realized the ferocity was a bluff.*

*On reaching shore we were amazed at the millions and millions of Pallas murres roosting in ledges of New Bogoslof, or Castle Rock . . . . We walked round old Bogoslof to see the new eruption which had arisen in the center of the crater. The first thing we did was to take the temperature of the hot sulphur water which surrounded it and found it to be 72½°.*

*My husband and most of the crew decided to swim in the hot crater; Frances Ames and I hurriedly walked along the spit to get away. They had a beautiful time splashing about the greenish and copper colored water, finding below the surface a slimy green ooze in which they sank until their feet reached a hard strata too hot to stand on . . . . The crater continually threw off steam, and strong sulphur fumes enveloped the adventurous men.*

*While the men had their small boys' picnic, we crossed a narrow piece of lava-covered land toward the sea, and here sat on one of the many lava deposits to watch the hundreds of sea lions. The animals were over cautious on our approach and stampeded into the breakers before we could approach very close. When the sand colored beasts reached the water they bellowed and snorted at us from their safe distance. The bulls were larger and heavier than bull hair-seals but much smaller than the Pacific Walrus. More extraordinary still, the cows were smaller than hair-seal cows, and our first impression was that of many bulls and half-grown pups. We suddenly realized, however, that sea lions also have harems. There were the useless bulls, and small groups of bachelors who seemed to be "talking it all over."*

On September 10, 1927, the *Northern Light* sailed through the Golden Gate back into San Francisco harbor, nearly five months since her departure. More than 10,000 miles of water had passed beneath her keel. As a scientific enterprise the expedition had fulfilled all expectations and, to all accounts, it had proven to be a thrilling, highly enjoyable venture for everyone aboard. Ashley Hine returned to his duties at Field Museum, the Bordens, the Goodspeeds and the Slaughters resumed their professional and social activities in Chicago. Frances Ames returned to San Francisco and the Sea Scouts rejoined their families.

In very short order the Museum took stock of the specimens acquired by the Borden expedition. On October 12, Museum director D. C. Davies wrote Frances Ames in appreciation for her collected plant specimens:

"I am informed that the plants recently received by Field Museum from the Borden-Field Museum Alaska-Arctic Expedition were collected by you. It is found that 106 of the plants are good specimens which will be a most welcome addition to the Herbarium. On the whole they are much better than the usual collections received from Alaska, some are very excellent indeed, and they are very acceptable to the Department of Botany. Permit me to congratulate you and to thank you for your interest . . . ."

On October 14, Berthold Laufer, head of the Department of Anthropology, filed with Davies the following report on the ethnological specimens acquired by the expedition:

"I beg to report that the Eskimo material collected by Mr. John Borden . . . has been duly accessioned and listed, and consists of a total of 533 objects. The collection is most interesting and attractive, and has been brought together with intelligence and discrimination. It represents a very valuable addition to the Museum's previous collections relating to Eskimo life, and many objects in it are entirely new to the Museum, above all, copper knives and copper arrowheads from the so-called Blond or Copper Eskimo of northern Canada, of which the Museum heretofore did not have a single example, and a wonderful series of ancient mammoth ivory carvings engraved with designs of a style which reveals an ancient phase of Eskimo art hitherto unknown. The abundance of walrus ivory carvings, many of great beauty and artistic merit, renders the collection particularly valuable to the student of Eskimo art and very attractive to the general public.

"I am exceedingly grateful to Mr. Borden for having exercised so much care in labeling his material exactly according to the localities where it was obtained, and this accurate information enabled me to make a temporary exhibit of selected material from this collection in Stanley Field Hall within a short time.

"As an interesting incident I may mention here that one day while I was going over Mr. Borden's collection Mr. Collins of the United States National Museum of Washington called on me. He had just returned from an expedition to Alaska on behalf of the National Museum, hunting for old Eskimo material. I showed him Mr. Borden's collection, and he was amazed at its fine quality and rarity, especially the stone and pottery cooking vessels, and said with reference to several objects that he had been unable to obtain them or that they were not even in the National Museum—all of which no doubt will be gratifying to you and the Board of Trustees as it is to myself."

*(Continued on p. 29)*

# Treasures of Russia and the Ukraine

## 20-day tour for Field Museum Members and their families

The Kremlin, Moscow

*THE SPLENDORS OF OLD RUSSIA, the excitement of the New are in store for Field Museum Members and their families who join the tour "Treasures of Russia and the Ukraine," leaving Chicago's O'Hare Airport June 19 and returning July 8.*

*Highlights of this exclusive tour will include visits to the cities of Moscow, Vladimir, Kiev, Leningrad, Petrovorets, Novgorod, and Petrozavodsk. The group, limited to 35 persons, will be led from Chicago by two Russian-speaking escorts, with additional guides while in the Soviet Union provided by* Intourist *(the Soviet Travel Bureau).*

*The tour cost—$2,970 (which includes a $500.00 donation to Field Museum)—is based upon double occupancy and includes round trip air fare from Chicago to Moscow, with intra-Russian air transportation where required. The transatlantic airline is Swissair.*

*Deluxe hotel accommodations will be used throughout or, where necessary, the best hotels available. The package includes all meals, including inflight meals; all sightseeing via deluxe motor coach; all admissions to special events and sites, where required; all baggage handling throughout, plus all necessary transfers; all applicable taxes and tips; all applicable visa fees. Advance deposit required: $250.00 per person.*

*For full itinerary, additional details, and registration information, please write or call Michael J. Flynn, Field Museum Tours, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.*

*1. Green peach aphid air dried onto rubber cement and coated with gold for viewing in the SEM. Magnification 204x.*

# Chance Encounter Of A Good Kind

BY ALAN SOLEM

Scientists have been defined as "children who never lost their sense of wonder and never stopped asking 'Why?'." There is no question but what the thrill of discovery and satisfaction of finding out "Why?" is a major part of our professional world.

Part of the joy of science at Field Museum is continually being surprised by the variety of structure and function in nature. Often, these surprises come very unexpectedly. One such occurrence is shared with you here.

As part of the evening adult education course on scanning electron microscopy offered last spring at Field Museum, I prepared objects and specimens brought in by the students for examination and photographing in later sessions of the course. The range of things contributed included semiconductors, millipore filters, human hairs, snow leopard claws, spiders, flies, and an aphid off a house plant. One of the participants, Mary Ellen Rinkus, had asked how to get rid of aphids from a new house plant and a week later brought in one lone survivor on a leaf of the purple velvet plant, *Gynura aurantiaca*.

When prepared for viewing and first seen, the limp and shrunken aphid did not look particularly impressive (*fig. 1*). Its mouthparts were hidden and the abdomen and legs were far less spectacular than those of a fly or spider. Just as I was about to abandon this aphid for a different sample, I noticed a couple of little bumps on its antenna. A slight reorientation and higher magnification view (*fig. 2*) confirmed my interest. This picture would have been past the limit of viewing with a dissecting microscope. Another click of the dial and refocusing showed that these bumps were hollow (*fig. 3*). Here would have been near the limit of a compound microscope.

Later, I found out that the presence of these "bumps," or "primary sensoria," had been known for many years. Indeed, whether there are one or two on each antenna is significant to entomologists trying to identify families and genera of aphids. Standard monographs on aphids illustrate these "primary sensoria" as circles on outline drawings of the antenna (*fig. 4*). The limitations of optical microscopes had prevented more detailed study. But this evening we had fun in seeing something that was equally unknown and marvelous to teacher and students.

Quickly focusing on the lower sensorium (*fig. 5*) and a nearby seta (projecting sensory hair) showed that the former had a hard covering, center hole with flanged edges, and a large, partly

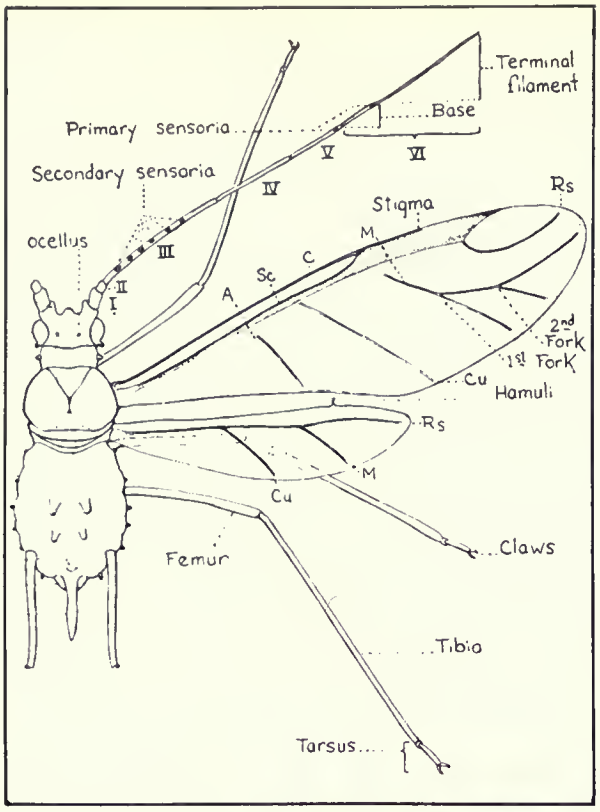
Alan Solem is curator of invertebrates.

*2. Portion of aphid antenna. Magnification 338x.*

collapsed pillowlike structure inside. Viewing at another angle and slightly higher modification (*fig. 6*) confirmed the type of edges and the collapsed internal soft structure.

The upper sensorium proved to be much more complex. The entire structure was subdivided into six areas (*fig. 7*), each with a separate little organ inside. The low partitions between each area are clearly seen at the lower left, and the protective nature of the "canopy" which mixes openness with narrowing projections shows more clearly than at lower magnifications. A slight change in viewing angle (*fig. 8*) was followed by a high magnification look at one of the individual sense organs (*fig. 9*). The actual function of these organs can only be guessed at. Probably they sample minute traces of chemicals in the air, but since previously they were not even recorded in the

*3. Portion of antenna at 876x magnification.*




4. *External anatomy of aphid. Drawing from "The Plant Lice, or Aphiidae, of Illinois,"* Bulletin of Illinois Natural History Survey, *19 (3).*

technical literature, our lack of understanding as to their function must be expected.

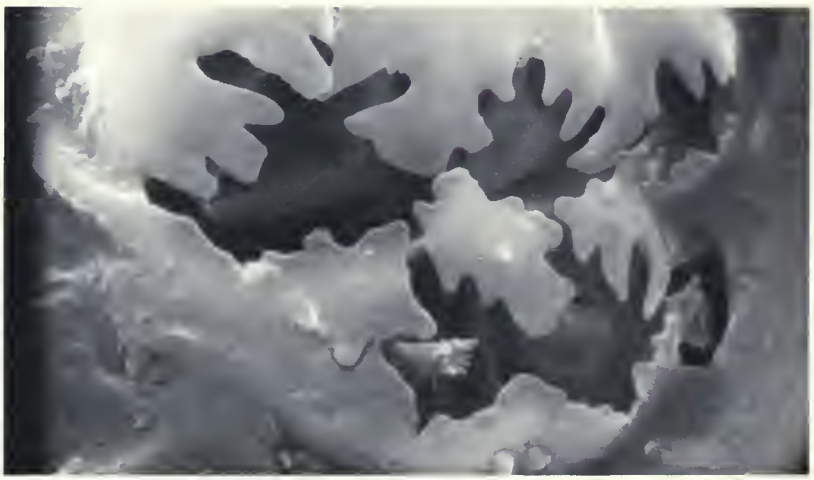
The next morning, our entomologists were visited by me with a sheaf of pictures in my hand. They were as amazed and delighted as the class and I were with these photographs. Quick checks in standard taxonomic works showed the published level of knowledge revealed in fig. 4. Our minds filled with many questions. First we had to find out which of the many thousands of aphid species we had been looking at. Field Museum has no specialist on aphids and, with the commerce in cultivated plants, aphids are continually being introduced to new areas. Mary Ellen Rinkus searched her plant in vain, visited the florist where two weeks before she had obtained her purple velvet plant, and triumphantly delivered aphid-loaded leaves to the Museum's shipping room. The aphids were preserved in alcohol. Curator of Insects Henry Dybas was planning to visit a major agricultural insect laboratory in California and agreed to hunt for an aphid specialist willing to identify the aphid. In due course, the specimens were shipped to Dr. T. Kono in Sacramento, who identified them as the green peach aphid, *Myzus persicae* (Sulzer).

5. *Lower primary sensorium and seta of aphid antenna at 2,697x magnification.*

6. *Lateral view of lower sensorium at 7,250x magnification.*

*7. Upper primary sensorium in vertical view at 8,316x magnification.*

*8.* (Middle) *Slightly lateral view of upper primary sensorium at 5,544x magnification.*
*9.* (Below ) *Detail of one organelle from upper primary sensorium at 24,092x magnification.*



Specialists in insect structure and function will have to work out the meaning and variation of these structures. Are most aphid sensoria alike or do they differ radically among groups? What are their functions? Are they unique to aphids or found in related insects? These and new questions derived from seeking the answers can occupy scientists in many places, since initial chance observations such as these only open the door to research.

In the same way that in the early 1600s the original Dutch and English microscopists looked into a new world with their new tool, the optical microscope, this generation of biologists is looking at a new submicroscopic world with our new tool, the scanning electron microscope. Thousands of scientists since the 1600s have used and continue to use optical microscopes to investigate the world too small for our eyes to see, and have far from exhausted research possibilities. It will take thousands of scientists working for hundreds of years to exploit the research opportunities revealed by use of the scanning electron microscope. To be able to participate in the beginning phases of this exploration is indeed one of the great joys in science at Field Museum, even knowing that following up most of the queries raised must be left to others, perhaps even generations removed in time.

Other chance encounters occur in my own research and some are followed up by me, but this is a series of different stories. □

# *Of Land Bridges, Ice-Free Corridors, And Early Man In The Americas*

BY GLEN COLE

*Photos by the author*
*Artwork by Louva Calhoun*

Several questions which have long intrigued scholars interested in the native peoples of the New World are: Where did these people come from?, how did they get to this hemisphere?, and how long have they been here? Present day students of Early Man* in the New World are still concerned with these questions or certain aspects of them, although the emphasis has shifted to the time of arrival of the earliest immigrants. In general, there is no longer any real question as to where the ancestors of the American Indians came from although more specific problems remain. The means by which they arrived, particular routes taken after arrival, and manner of dispersal through the Americas remain unsettled issues.

Individual papers devoted to Early Man in the New World have long been standard fare at scholarly meetings. Sessions within such meetings and occasionally an entire meeting might be given over to the subject. These are usually held under the aegis of anthropological or archeological organizations, and although contributions from persons in disciplines outside anthropological ones are usual enough, probably none has heretofore had such a diversity of input as did a recent meeting of the American Quaternary Association (AMQUA) held in Edmonton, Alberta, in September 1978.

Ten years ago AMQUA was founded for the purpose (amongst others) of promoting the study of the North American Quaternary, a period of geologic time covering the last 1.6 or 1.8 million years, and facilitating communication between workers in different fields. These communications are facilitated by the sponsoring of biennial scientific meetings that are built around a symposium on a topic of broad interest to constituent AMQUA groups. These groups include general disciplines ranging from archeology to zoology, narrower disciplines such as climatology, ecology, limnology, physical geography, soil science and various biological and geological subdisciplines.

Archeology might seem somewhat out of place in this company, at least from the viewpoint of the academic scheme of things in the United States; here it is usually grouped with the social sciences, as a subdivision of anthropology. As such, it is the only major discipline within AMQUA which falls outside the biological and physical sciences. More importantly, archeology is peculiar in that it is the only one of the disciplines represented which is concerned only with a particular part of Quaternary time. Whether one considers that humans have been in the New World for 15,000 years or twice that long, this constitutes a very small portion — less than 2 percent — of the Quaternary Period.

This doubtless has been a factor in determining the symposium topics of the four AMQUA meetings held previously. Three of these focused on particular aspects of the last part of the Quaternary. The fifth biennial AMQUA meeting in Edmonton followed this pattern but, in addition, was the first to use an archeological subject as a theme of the symposium. Accordingly, this symposium on "The Ice-Free Corridor and Peopling the New World" drew a large contingent of archaeologists.

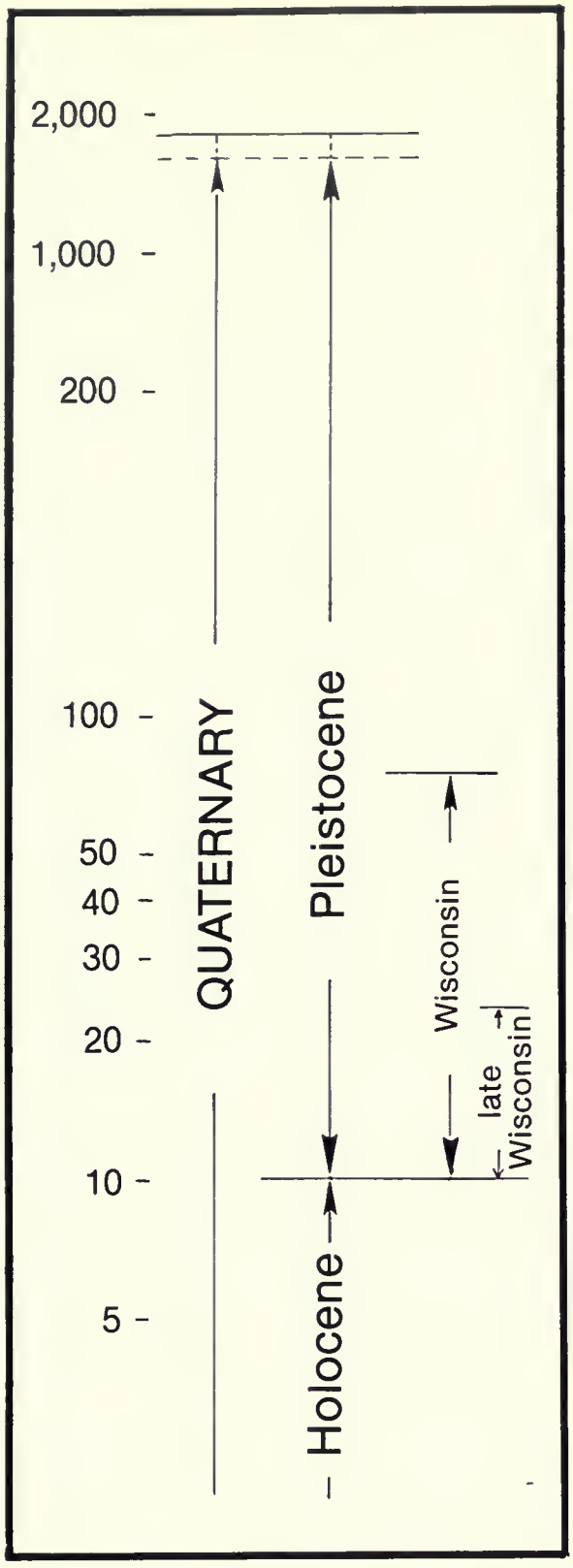
AMQUA symposium topics and meeting places are not unrelated. Edmonton lies in the "ice-free corridor" area and field sessions before and after the regular meeting permitted participants to examine glacial features pertaining to mountain and continental glaciation.

The whole subject of peopling the New World is marked by a dearth of sound evidence and, as a usual corollary to such situations, by a wealth of speculation. There is general agreement that the ancestors of the native American populations must have come from Asia and, for want of reasonable alternatives, that they must have

*"Early Man," as used here, refers to Early Man in the New World. From the vantage point of the Old World, Early Man in the New World is very late indeed.*

→*Athabasca Glacier. One of several descending from the Columbia Icefield in the Canadian Rocky Mountains southwest of Edmonton, Alberta. This is a remnant of a once extensive glacial system which extended beyond the mountain front to meet Laurentide ice and form the southern end of the late Wisconsin ice barrier.*

*Glen Cole is curator of prehistory. He describes himself as "an Old World prehistorian who is generally concerned with a much earlier time period than is covered in this article." Cole is, additionally, a charter member of the American Quaternary Association (AMQUA) and has followed with interest studies relating to Early Man in the New World. In this article he discusses recent developments in North American Early Man studies as presented at the 1978 biennial meeting of AMQUA, at Edmonton, Alberta.*




*The Quaternary Period, which covers the last 1.6-1.8 million years of geologic time, is divided into two epochs, the Pleistocene and the Holocene. The last major glacial stage, ending 10,000 years ago, is known, in North America, as the Wisconsin. The Wisconsin, punctuated by several cold stadials and warmer intervals has been variously subdivided. For purposes of this article, it is simply divided into an earlier and a later portion. The more recent, late Wisconsin, will be that period from 23,000 before present (B.P.) to the beginning of the Holocene. The figures represent thousands of years.*

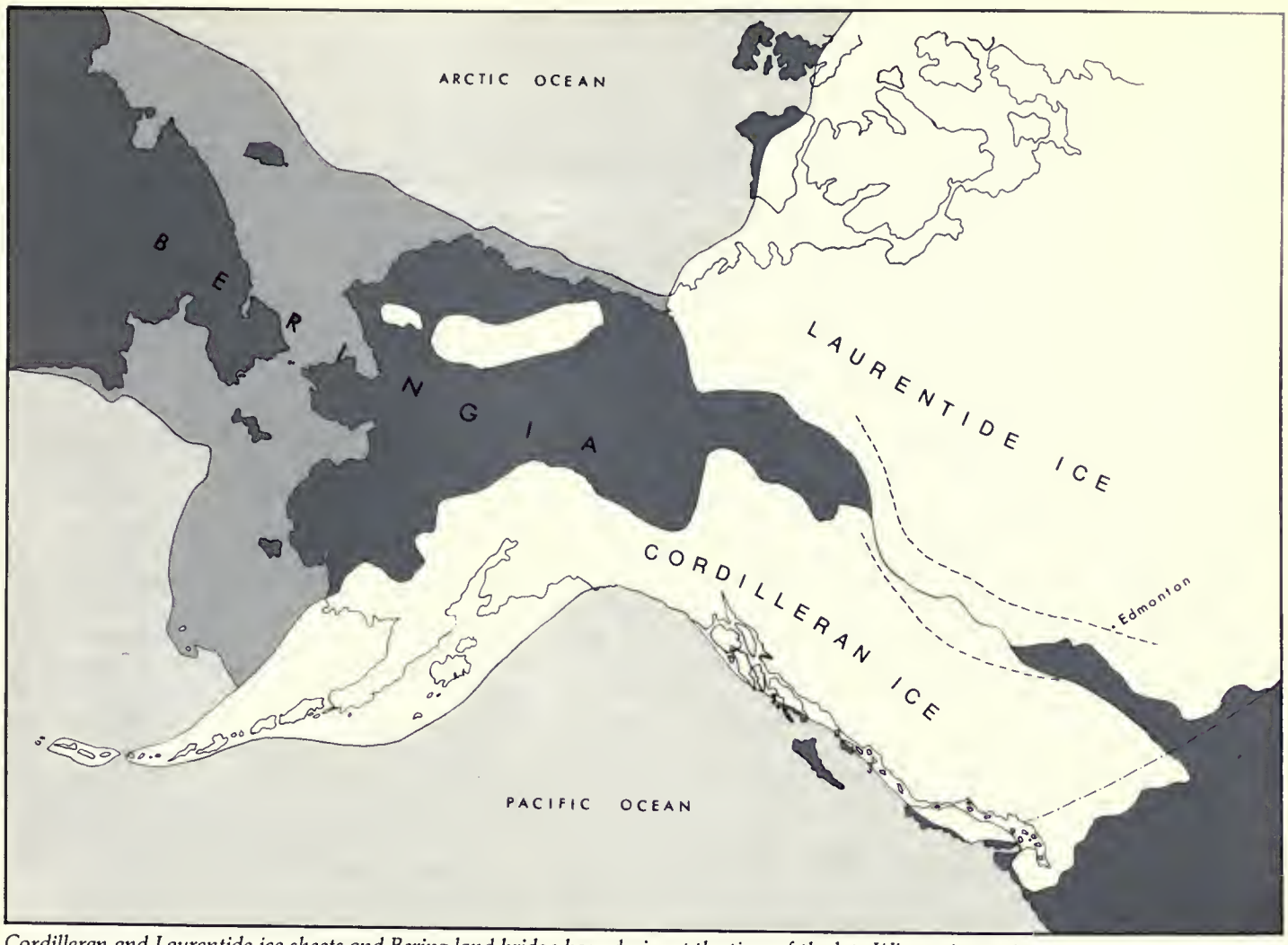
entered the New World through Alaska. The obvious place to seek the "roots" of the native American, then, is the adjacent part of Asia. But vast areas of northern Asia — Siberia, Mongolia, Manchuria along with much of the rest of China — and much of the northwestern part of North America for that matter, are virtually unknown archeologically. Students of Early Man in the New World have had to seek comparative material as far afield as the Ukraine and other eastern European areas. Some of the more important sites in the Lake Baikal region of central Siberia, although a good deal closer to the Bering Straits area, are as far removed from it as are many well known Paleo-Indian sites in the lower 48 states. Nor is much known of the later Pleistocene archeology of the maritime provinces of China and other Asian countries of the north Pacific area.

As more students of the American Quaternary have been learning the languages of the countries concerned, increasing amounts of information on the little that is known of those vast areas is becoming available. Even so, the New World archeologist has little comparative data to draw on. Not only are the data sparse, but the scholar who takes the trouble to learn Russian (or Chinese) soon finds that many of the Asian prehistorians are not nearly as interested in problems of peopling the New World as he or she might have wished, and their reports are often not very informative or useful in this regard.

Probably because of this paucity of direct evidence, students of Early Man in the New World have relied heavily on nonarcheological data in attempting to answer these questions. Incursions of people into the New World have been assigned to periods when land connections existed between Asia and North America. And then it has been supposed that man would not have been able to reach the central part of North America until the ice barrier separating the extreme northwestern portion of the continent from the rest of it was breached.

Unfortunately, the nonarcheological data have been none too secure either. Not too many years ago there were those—including some geologists—who denied the existence of an Asian-American land connection. More recently there has been, and remains a lack of agreement on whether an ice-free corridor came into existence before the Paleo-Indians were well established in the New World.

The single most important contribution to Early Man studies in recent years (and to archeological studies in general) has been the development of radiometric dating techniques. These, especially radiocarbon dating, have been making possible a much more concise chronology than was attainable a generation ago and new dates are appearing regularly. And, other new data are continually being produced. New archeological finds pertaining to Early American



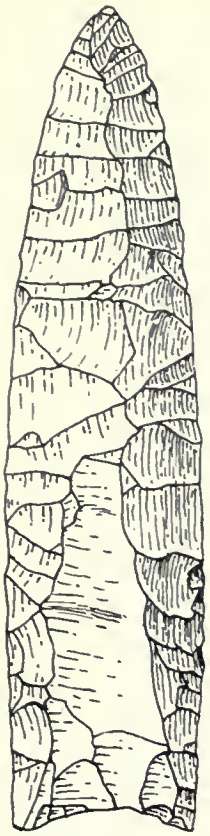

*Cordilleran and Laurentide ice sheets and Bering land bridge boundaries at the time of the late Wisconsin maximum. Dashed lines indicate approximate position of the ice-free corridor, perhaps 12,000 years ago.*

Man are being made and some long standing studies are continuing. In addition to new and ongoing geological mapping projects, there are studies in geomorphology, glacial geology, sedimentology, and stratigraphy. There are paleontological and climatological investigations, studies of plant successions and faunal distributions, to cite a few — studies that are not directed to the question of peopling the New World, of course, but which often provide information relevant to that subject.

Before discussing some of the contributions presented and more pertinent information disseminated at the AMQUA sessions, it would be well to go over a little background material:

Although ice in the form of mountain glaciers and polar ice caps has been on the earth since long before the Pleistocene Epoch, it seems that the period of the classic "Ice Age" marked by extensive continental glaciation in the Northern Hemisphere did not set in until ¾ million years ago. There is considerable debate concerning earlier Pleistocene glaciations and correlations between those of North America, Europe, and Asia; but that need not concern us here — there is quite enough disagreement concerning late Pleistocene glaciation. What is relevant to the question of getting Early Man to North America is the last major glacial period. A warm interglacial interval which ended an earlier glacial stage about 125,000 years ago was terminated by a cooling trend 75,000 years ago. The following period of extensive continental and mountain glaciations punctuated by intervals of glacial retreat is known in North America as the Wisconsin Age. By common, if not unanimous agreement, the Wisconsin is considered to have ended at the convenient figure of 10,000 years ago. The present nonglacial interval in which we are now living is known as the Holocene.

The ice-free corridor was a narrow strip of land along the eastern flank of the Rocky Mountains, which was exposed when coalescing mountain (Cordilleran) and continental (Laurentide) glaciers had begun to retreat after the late Wisconsin glacial maximum. This is not to say that there were not earlier glacial episodes. It is this last corridor that has loomed large in discussions of peopling the New World which is conventionally referred to as *the* ice-free corridor and which was the concern of the AMQUA symposium and field sessions.



*Fluted Clovis point (actual size) from Blackwater Draw locality no. 1 near Clovis, New Mexico. This type of point characterizes earlier Paleo-Indian occurrences (ca. 11,500-11,000 B.P.).*

Perhaps the area most crucial to the question of peopling the New World is the so-called Bering land bridge, a broad plain joining Asia and North America which was dry land from time to time during the Pleistocene but which now lies beneath the sea. Sea level fluctuated considerably during the Pleistocene because of climatic events which favored formation of enormous masses of ice at higher latitudes and elevations of the earth. On occasions when sea level had dropped by 150 feet, enough of the floor of the Bering and Chukchi Seas emerged to form a land connection between Siberia and Alaska. This "vast arctic lowland," the land bridge along with the contiguous low-lying areas of Siberia and Alaska plus a little of the Canadian Yukon Territory, is known as Beringia. Much of Beringia was not glaciated even during periods of maximum glacial advance and so provided a refugium for arctic plants and animals. So much water was locked up in ice during the maximum extent of the late Wisconsin glaciation that sea level was lowered by more than 300 feet, exposing a land bridge over 1,000 miles wide.

The question of when man first arrived in the New World is a vexed one. Most students of Early Man have been inclined to see the existence of the Bering land connection as necessary for people to have been able to reach the New World. In this view hunters would have drifted gradually eastward into new terrain as directed by the presence of the large mammals upon which they preyed. The most likely time would have been during the period of 22,000 to 15,000 years ago, although people, if any were living in western Beringia then, could have reached the New World during an earlier period of reduced sea level before 30,000 B.P. (before present).

Others argue that man could just as well have moved across the Bering strait on winter pack ice or negotiated small passages between ice floes and islands by boat. Also in favor of the idea that boats were used are a few who are inclined to favor colonization by seafaring people from Asiatic maritime provinces. By either of these views there would be no reason to restrict the time of man's entry into the New World to a period of low sea level.

In any event, the entry of human immigrants into the Americas would have depended on the degree of technological advancement they had reached. A string of islands such as the Aleutian chain would have been useless to people without boats, but it is now known that man, with the aid of boats or other means of crossing appreciable stretches of open water, reached Australia as much as 40,000 years ago. There is no reason to think that other people farther north in the Asian Pacific coastal area wouldn't have been similarly advanced technologically, and such people could have worked their way around the Pacific Rim, eventually reaching parts of the Pacific coast of North America.

The presence of the Bering land bridge would be of no use to man if the cultural paraphernalia which would permit living in an arctic or subarctic environment had not yet come into being. Man does seem to have been able to exist in cold environments 200,000 years ago in the European area at least. Closer to Beringia, we know that Peking Man was living in northern China some 300,000 years ago, although under somewhat milder conditions, and there is no reason to suppose that this represents the northernmost extension of human distribution at that time.

None of this, of course, can be taken to indicate that humans actually did reach the New World at these early dates, but it does mean that certain arguments that have been used to discount claims for Early Man in the Americas can no longer carry the weight they once did.

Firmly dated archeological evidence is needed to determine when peopling of the New World occurred, but no really secure evidence is found until the very end of the Pleistocene. This is now available in relative abundance since about 12,000 years ago. Between 11,500 and 11,000 B.P. there is a rash of Early Man occurrences. Most of these in North America are characterized by a distinctive, fluted projectile point known as "Clovis" (after a site near Clovis, New Mexico, one of several in the Llano Estacado, where such points have been found). The complex of artifacts and activities centered around hunting of large Pleistocene mammals, particularly elephants, is known as the Llano, or Clovis, Culture (this is to be discussed in more detail later). There is sparse evidence of other big game hunters in Central and South America at the same time or even somewhat earlier.

By 10,000 B.P. evidence of Paleo-Indian occupation is widespread in the Americas, extending from the tip of South America to Alaska. Before 12,000, however, the evidence is much more meager. There is a mere handful of likely Early Man sites in the Americas between 15,000 and 12,000 years ago. One of the most promising is the Meadowcroft Rockshelter in Pennsylvania, now being excavated, which has good evidence of human occupation as early as 15,000 to 16,000 years ago and perhaps even before.

There are a few possible Early Man sites which have been dated to the 20,000 to 30,000 years ago range, notably a couple in Mexico, and a few more on the basis of equivocal evidence, to even greater ages.

Probably the most exciting recent evidence in this *very* Early Man area, vying in interest with the Meadowcroft site, has been coming from the Old Crow Basin of the Canadian Yukon Territory. Although the work along the Old Crow River wasn't discussed per se at the symposium, some of the results of the work were presented at a "poster session" and during an informal talk given during the post-meeting field session. Two groups of

Canadian researchers have been working in the area and a number of participants were present at Edmonton and on the field sessions, so there was ample opportunity for discussion.

The Old Crow River has entrenched itself in a thick sequence of old lake and alluvial deposits. Large glacial lakes were formed in the basin on two separate occasions when the Porcupine River, to which the Old Crow is tributary, was blocked by glaciers. During the interval between the lakes, deposits from coalescing alluvial fans covered much of the basin.

Bones of various later Pleistocene mammals have been found in abundance at numerous sites along the Porcupine and Old Crow. Along with these bones were found several hundred bone artifacts; that is, bones that have been altered by man, whether from butchering activities, breaking to extract marrow, or as raw material for tool making. These have come mainly from secondary alluvial deposits, which means that earlier sediments have been reworked by riverine activity so that material of different ages has been mixed. An age cannot be assigned, therefore, to the few stone tools that have been found associated with the worked bone on gravel bars in the river, but the bone pieces themselves can be directly dated by means of the radiocarbon in them. Several bone tools have yielded dates in the range of 25,000 to 29,000 radiocarbon years B.P. R. Morlan of the Archeological Survey of Canada, a member of one of the projects, reported that some recently obtained dates on broken or flaked bones, which are apparently artifactual, are considerably older, in some cases exceeding the limits of the carbon 14 method.

There is a possibility that the bone tools and other artifacts were made in the relatively recent past by Indians using the old mineralized bone, or perhaps, old nonmineralized bone preserved in frozen condition in permafrost and released from the river bluffs by stream action. Experimental work on mineralized bone from the Old Crow basin sediments indicates that such bone cannot be worked, as can green bone, to produce the kind of fractures seen in Old Crow artifacts. The possibilities concerning frozen bone are still being explored.

During the last few field seasons, two horizons in the river bluffs have been located from which the bone artifacts seem to be coming, but none have yet been found in undisturbed context.

The presence of humans in Beringia 25,000 to 30,000 and perhaps to more than 50,000 years ago doesn't necessarily mean that these people figure in the peopling of the Americas. Eastern Beringia has on occasion been connected with Asia at times when it was more or less isolated from the rest of the North American continent. At these times it can more properly be considered as an extension of northeastern Asia than as a part of North America. Various Asiatic animals are known from eastern Beringia that either never established themselves elsewhere in North America or did so at a time long after their appearance there. This may also have been true of some early human inhabitants of the area.

There are a few archeological sites scattered throughout Alaska which have yielded material for radiocarbon dates in the range of 10,000 to 12,000 years ago. A long gap separates these dates from the 25,000 years and older dates from Alaska and the Yukon. This gap also pertains to the situation as known so far from the Old Crow Basin. This could simply be a chance result of the incomplete archeological record but, as one AMQUA discussant, T. D. Hamilton of the U.S. Geological Survey, suggested, other factors may also be involved. Hamilton has worked for the last 16 years in another part of the Yukon drainage on the south side of the central Brooks Range in Alaska. Although he has studied and mapped more than 100 late Pleistocene to Holocene exposures in this area, no artifacts or other evidence of man's presence before about 6,000 years ago has been found. The absence of such evidence for a relatively well studied area "suggests that the distribution of Early Man in northwestern North America may not have been continuous in either space or time."*

J. D. Jennings, in introducing his recently edited book on *Ancient Native Americans* (W. H. Freeman & Co., 1978), states that "at once the most important and least dramatic event in American history was the passage of the first man from Asia into the New World 30,000 or more years ago." In writing this, Jennings evidently supposes that the first people to set foot in the New World would *ipso facto* have become the ancestors of the Paleo-Indians and eventually the American Indians found at the time of European contact. Actually, there would be nothing particularly odd in the early human inhabitants of eastern Beringia dying out or withdrawing during the deteriorating climate of the late Wisconsin glaciation. Within historic times we know of large areas of the American arctic that have become depopulated and of the extinction of entire local populations. It should also be remembered that technologically more advanced peoples in recent times were unsuccessful in establishing themselves on the opposite corner of the North American continent. Norse settlements founded in the tenth century A.D. failed to survive, evidently due to deteriorating climatic conditions in the fourteenth and fifteenth centuries. Although not without interest, the presence of those early colonists was essentially irrelevant to the peopling of the New World. So may it have been with the early Beringians.

From time to time during the Quaternary,

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**All quotations, unless otherwise indicated, are taken from the* Abstracts *of the fifth biennial meeting, American Quaternary Association, Edmonton, Alberta, 1978.*

at the maxima of certain glacial episodes, continental ice encroaching on the mountain front was met by tongues of Cordilleran ice to form a continuous ice sheet. Just how often this happened is not known, since deposits of the earlier glacial episodes are much less well preserved or exposed than are those of recent glaciations. But even the configurations of late Wisconsin ice are unclear. Earlier Wisconsin glacial deposits are more extensive than those of the late Wisconsin in the corridor area. It is not always easy to distinguish between the earlier and later deposits occurring there. Organic material which would be suitable for radiocarbon dating is usually absent from these deposits.

Not all fronts of an ice sheet were synchronized. An ice lobe in one area could be advancing while another front was at a standstill or even retreating. A warming trend, which could result in ice thinning and accelerated flow at the terminus, could effect separate ice masses, or discrete portions of the same one, differently. Effects of the warming could be manifest at the toe of a mountain glacier system long before they would be felt at the front of the more massive Laurentide ice sheet. Such seems to have been the case in Alberta, where Laurentide ice overran deposits of the retreating Cordilleran ice. (Because of the very different rocks contained in the deposits derived from the two glacial systems, it is not difficult to distinguish between them.) However, the Laurentide ice did not reach the mountains in this area and did not encounter Cordilleran ice until much farther north. Laurentide ice did reach the Richardson and MacKenzie mountains in the Northwest Territories, but there the late Wisconsin glaciation was not extensive. Terminal moraines of the valley glaciers occur well back from the Laurentide ice margin so a rather rugged ice-free zone remained. Thus, even at the height of late Wisconsin glaciation there were appreciable ice-free reentrants at either end of the incipient corridor. It was in the central part of the corridor mainly along the mountains in northeastern British Columbia and a little of adjacent Alberta that there seems to have been a formidable late Wisconsin ice barrier.

In summarizing geological evidence pertaining to the corridor area, N. W. Rutter, a University of Alberta geologist, concluded "there was only a short period of time when Laurentide-Cordilleran ice could have coalesced in Wisconsin time . . . . This could have been in Early Wisconsin time, which we know little about, and in Late Wisconsin time . . . for a maximum of about 10,000 years." That is, the corridor has been blocked by ice for only about 10,000 of the past 70,000 years.

According to geologist W. H. Mathews of the University of British Columbia, who has been working in the British Columbian part of the corridor, retreat of the ice there seems to have begun about 13,500 years ago. He estimated that it took nearly 2,000 years for the ice to withdraw to a point 150 miles to the northeast.

Even after converging ice masses had withdrawn sufficiently to provide an ice-free corridor, one shouldn't think that easy passage southward would have been assured. Melting ice provided a large volume of meltwater to supplement runoff from the mountins and local rainfall. Old drainage lines were still blocked by Laurentide ice and local drainages choked with glacial debris so that much of the floor of the corridor must have been inundated by the water of lakes—some of them very large — and by bogs and streams. These features in themselves would not necessarily have been serious obstacles to the movement of man and other animals, for they became quite passable when frozen over—a condition which must have prevailed for at least several months of the year.

A more crucial factor for human occupation than water barriers would have been the availability of sufficient food plants to support the animals upon which man, in turn, depended for subsistence. (Such environments provide little in the way of vegetable foods suitable for human consumption.) It would seem likely that the appropriate regional vegetation would have become established quickly enough in suitable terrain within the corridor, but it is difficult to guess how long it might have been before this was sufficient to support sigificant numbers of game animals. It may be that this situation would not have been realized before a normal drainage connection with the MacKenzie River had been reestablished. At present there seems to be no very good estimate as to just when that might have been.

Unfortunately, "The Paleoecology of the Ice-Free Corridor," discussed at the AMQUA meeting by J. C. Ritchie, a University of Toronto biologist, is too poorly known to contribute much to the subject of peopling the New World. There are a few scattered indications that the late Wisconsin glaciation was preceded by a period of environmental conditions similar to modern ones. There is no evidence as yet from the southern half of the corridor area for conditions prevailing from the time of the beginning of ice retreat until about 13,000 B.P., at which time forested conditions already existed in many localities. Ritchie suspects a prior one or two thousand years may be unaccounted for in the known sections. In the northern corridor area there is a little general information on regional changes in vegetation patterns between 14,000 and 13,000 B.P., but nothing, it seems, that might apply to the early stages of the corridor itself.

With the abundance of water in the early corridor, one might think that fish would have provided a possible food base. Zoologist C. C. Lindsey, of the University of Manitoba, in discussing "Aquatic Zoogeography and the Ice-Free Cor-

*View across the toe of the Athabasca Glacier. Such views with wasting ice, meltwater streams, and lakes would have been commonplace to any inhabitants of the ice-free corridor in its earlier phases.*

ridor," cited distribution of Yukon varieties of fish to indicate that streams normally tributary to the MacKenzie River, while still dammed by Laurentide ice, backed up to eventually spill over to the Yukon drainage; this temporarily extended its headwaters far to the southeast. Besides indicating that this part of the corridor, at least, was a very watery place, this suggests that fish may have been introduced at a very early stage of its development but again, no precise age can be assigned to the event. It may also be that refugia for fish persisted through the late Wisconsin. Lindsey cited one such possibility somewhat farther south in the corridor.

The results of recent field work have tended to indicate that late Wisconsin ice was less extensive than had once been supposed. A. MacS. Stalker, a geologist with the Geological Survey of Canada, is primarily responsible for working out the geology of the southern corridor area and is one who advocates a relatively weak advance of late Wisconsin ice. He nevertheless strongly doubts that an ice-free corridor had opened early enough to account for human occupation south of the ice sheet as early as 14,000 or 15,000 B.P. However, with the possibility that an essentially ice-free corridor may have come into being much earlier than currently seems to have been the case, Stalker, in his prepared comments for the Edmonton symposium, considered the nature of such a corridor.

He finds it difficult to imagine that passage of Early Man through a corridor at this early time would have been feasible, for reasons such as have already been given. In addition to lingering spurs of ice, bogs, and barren landscape left by retreating glaciers, frigid glacial lakes, and turbulent rivers, "there would have been the chilling winds blowing from the glaciers . . . and extended periods of intense cold as man slowly worked his way 1,000 km south through the narrow part of the corridor, not knowing where he was going or what he had to face. . . ."

Although some of the obstacles and disagreeable conditions Stalker envisages probably loom larger to the geologist studying the deposits and landforms left by long departed glaciers than they did to a people adapted to an arctic environment, he stresses an important point: if anyone emerged from the southern end of the corridor, it was incidental to occupation of the corridor area. There is no reason at all to think that Early Man arrived either in eastern Beringia or in the central part of North America as the result of purposeful migration. Traversal of the corridor would not necessarily have taken a great deal of time. It is not inconceivable that a group of individuals, within the lifetimes of some of them, might have worked its way the length of the corridor and emerged onto the plains of southern Alberta and into Montana, but they could not have done so until sources of subsistence — food, clothing, and shelter — were available there. The concept of an ice-free corridor involves a good deal more than simply some more or less dry ground to walk on.

On the basis of evidence currently available, the corridor does not appear to be a very promising route for immigrants into the central part of North America before 12,000 to 13,000 years ago. Stalker suggests that "perhaps it is just as well that the finding of indications of the presence of man in North America prior to the maximum of the [late] Wisconsin renders an ice-free corridor unnecessary, and offers the possibility that man may have migrated south in comfort and ease much earlier."

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*("Of Land Bridges, Ice-Free Corridors, and Early Man in the Americas" will be concluded in the March* Bulletin.*)*

# CONFLICTS BETWEEN DARWIN AND PALEONTOLOGY

1

Part of our conventional wisdom about evolution is that the fossil record of past life is an important cornerstone of evolutionary theory. In some ways, this is true — but the situation is much more complicated. I will explore here a few of the complex interrelationships between fossils and darwinian theory, but let me first set the stage by commenting about the geologic record itself.

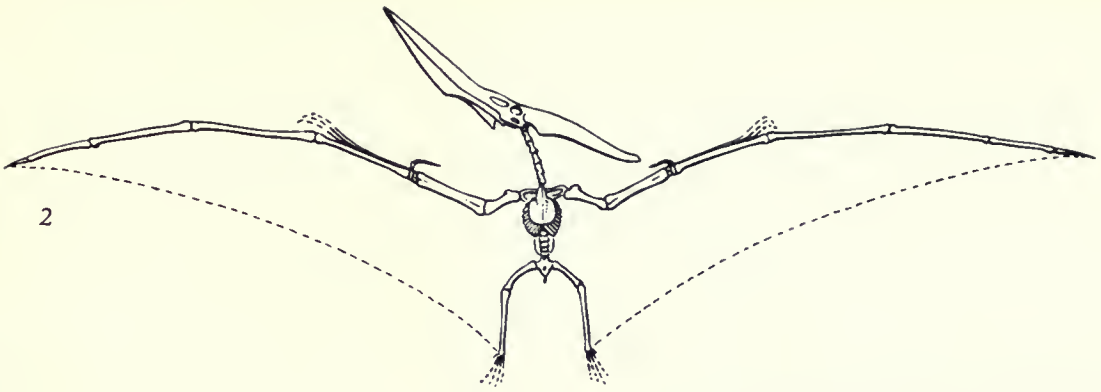
There are about 250,000 different species of fossil plants and animals known. These have been named and described and specimens have been deposited in museums throughout the world. Field Museum has in its collections representatives of perhaps 20 percent of these known species. In combination with other museums, we thus have an enormous amount of statistical information on changes in the biological world that have occurred since the origin of life on Earth. In spite of this large quantity of information, it is but a tiny fraction of the diversity that actually lived in the past. There are well over a million species living today and known rates of evolutionary turnover make it possible to predict how many species *ought* to be in our fossil record. That number is at least 100 times the number we have found. It is clear that fossilization is a very chancy process and that the vast majority of plants and animals of the past have left no record at all.

To many people, the most interesting fossils are the oldest ones and the youngest ones. The oldest ones (up to 3,500 million years old) give us information about the origin and early evolution of life — at a time when physical and chemical environments were very different from those that prevail today. The youngest rocks, on the other hand, are of interest because they include fossils of early man. These, of course, have been worked on with particular success by the Leakeys in East Africa.

But these extremes account for only a small part of the quarter of a million fossil species — and for one interested in the broad range of evolutionary change, the extremes do not contribute much. In between is a long geologic interval which contains the basic record of the evolution of all major groups of plants and animals. Time control and quality of preservation are excellent compared with the rather thin record of the oldest or youngest fossils. (I might point out here that the East African material the Leakeys have worked on is relatively poor, there are only a couple hundred specimens, and age-dating is very uncertain.)

Darwin's theory of natural selection has always been closely linked to evidence from fossils, and probably most people assume that fossils provide a very important part of the general argument that is made in favor of darwinian interpretations of the history of life. Unfortunately, this is not strictly true. We must distinguish between the *fact* of evolution — defined as change in organisms over time — and the *explanation* of this change. Darwin's contribution, through his theory of natural selection, was to suggest *how* the evolutionary change took place. The evidence we find in the geologic record is not nearly as compatible with darwinian natural selection as we would like it to be. Darwin was completely aware of this. He

*By David M. Raup, curator of geology*



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1 meter

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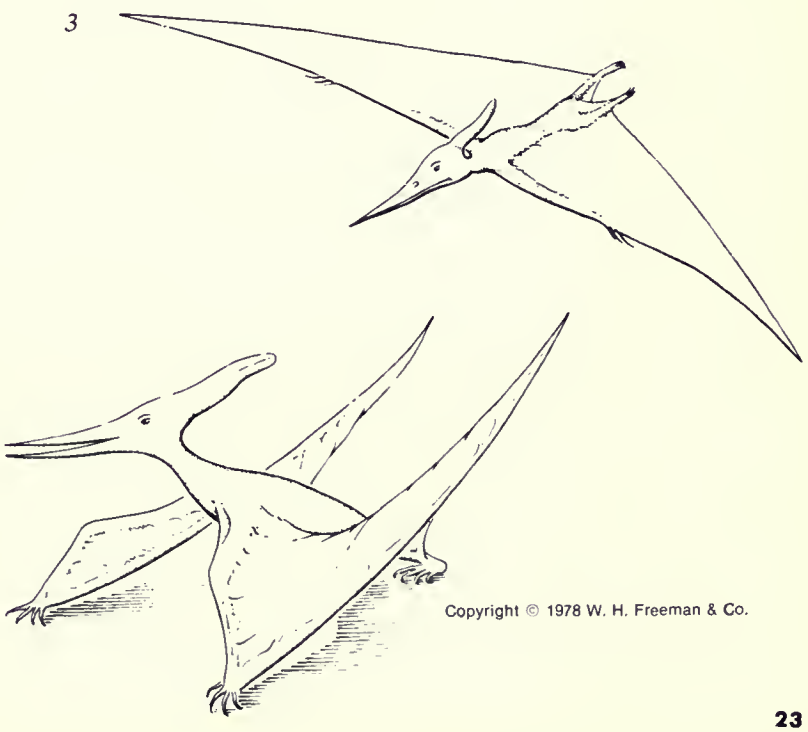
was embarrassed by the fossil record because it didn't look the way he predicted it would and, as a result, he devoted a long section of his *Origin of Species* to an attempt to explain and rationalize the differences. There were several problems, but the principal one was that the geologic record did not then and still does not yield a finely graduated chain of slow and progressive evolution. In other words, there are not enough intermediates. There are very few cases where one can find a gradual transition from one species to another and very few cases where one can look at a part of the fossil record and actually see that organisms were improving in the sense of becoming better adapted. To emphasize this let me cite a couple of statements Darwin made in his *Origin of Species*: At one point he observed, "innumerable transitional forms must have existed but why do we not find them embedded in countless numbers in the crust of the earth?"; in another place he said, "why is not every geological formation and every stratum full of such intermediate links? Geology assuredly does not reveal any such finely graduated organic chain, and this perhaps is the greatest objection which can be urged against my theory."

Instead of finding the gradual unfolding of life, what geologists of Darwin's time, and geologists of the present day actually find is a highly uneven or jerky record; that is, species appear in the sequence very suddenly, show little or no change during their existence in the record, then abruptly go out of the record. And it is not always clear, in fact it's rarely clear, that the descendants were actually better adapted than their predecessors. In other words, biological improvement is hard to find. Let me give an example: During the interval from about 65 to 200 million years ago there were a lot of flying reptiles known as pterosaurs (see "Pterosaur," by John Bolt, in the May, 1976, *Bulletin*). Their fossil record is quite good in spite of the fact that the skeleton of these animals is difficult to preserve. The giant *Pteranodon* was particularly spectacular. It was much larger than any bird living today and was widely distributed, particularly in the southern and southwestern parts of the United States.

*Figure 1* shows a reconstruction of *Pteranodon* as it probably looked. The mountains in the background are not there by accident: it is felt by some people that these reptiles could become airborne only by climbing up on cliffs and jumping. *Figure 2* shows the skeleton. Wings were formed by greatly extending the bones of one finger on each hand and filling in with skin the area enclosed by the dotted line. This is basically the device used also by some modern bats. There is little question that this animal was capable of flight — a conclusion based on sophisticated engineering studies involving extensive analysis of weight, lift, drag, and other aerodynamically important factors — along with wind tunnel experiments with scaled models.

*Figure 3* shows what *Pteranodon* probably looked like at rest and when flying. The most striking aspect of *Pteranodon* is its size, demonstrated



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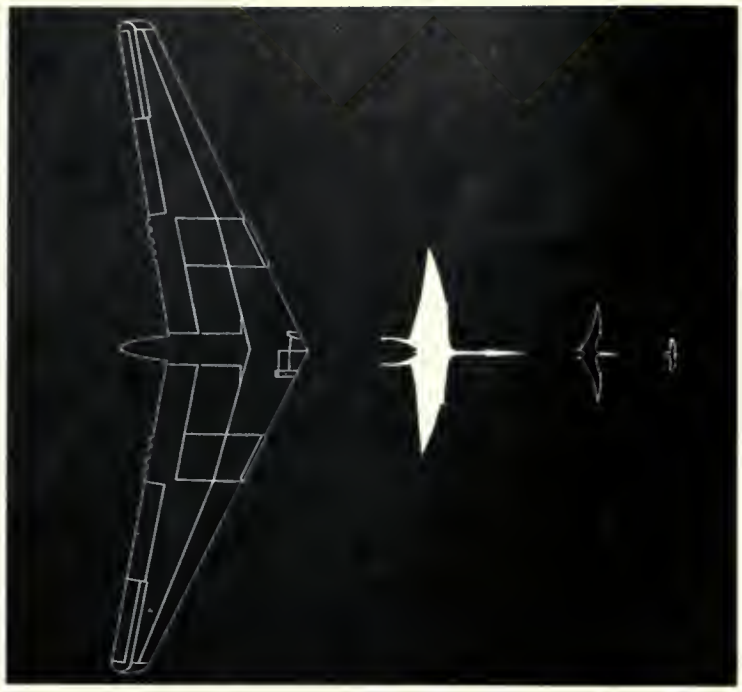

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*4*

in *Figure 4*, where it is shown in comparison with other flying objects. On the left is a modern tailless aircraft — the Northrop YB-49 — with a wingspan of about 170 feet. Next to it is the largest known pterosaur, which had a wingspan of about 50 feet. Next is a smaller pterosaur. The drawing on the far right shows one of the largest living birds — a condor with a wingspan of about nine feet. Thus, some pterosaurs were larger than all flying birds and even many small airplanes. They achieved this size and were still able to fly because their design was nearly optimal.

So here we have an adaptation which was apparently successful for many millions of years but which is now extinct and has not been repeated. That this animal went extinct implies some sort of failure. At least that is the conventional wisdom. *Pteranodon*, along with most other large reptiles, was replaced by mammals and birds. Mammals and birds were already around, but in small numbers. We assume in darwinian fashion that the big reptiles went extinct because there was something wrong with them; that is, they either couldn't compete with new forms that had evolved, or there was some change in environment that they couldn't adapt to fast enough to survive. As we will see, this interpretation may not be correct. We don't have any real evidence that there was anything wrong with the flying reptiles—in fact, they lived on the earth for a much longer time than humans have been around. During their tenure on earth the flying reptiles diversified into several quite distinct species but it is very difficult to put these species into any sort of series of improvement.

Here is another example: Figure 5 shows a fossil trilobite—a member of an extensive but now extinct group of arthropods. Figure 6 is a closeup of one eye of a trilobite. The eyes were generally large and quite similar to the eyes of modern insects, crabs, and other arthropods. But if we look at the individual elements of the trilobite eye, we find that the lens systems were very different from what we now have. Riccardo Levi-Setti (a Field Museum research associate in geology and professor of physics at the University of Chicago) has recently done some spectacular work on the optics of these lens systems. *Figure 7* shows sketches of a common type of trilobite lens. Each lens is a doublet (that is, made up of two lenses). The lower lens is shaded in these sketches and the upper one is blank. The shape of the boundary between the two lenses is unlike any now in use — either by humans or animals. But the shape is nearly identical to designs published independently by Descartes and Huygens in the seventeenth century.

The Descartes and Huygens designs had the purpose of avoiding spherical aberration and were what is known as aplanatic lenses. The only significant difference between them and the trilobite lens is that the Descartes and Huygens lenses were not doublets — that is, they did not have the lower lens. But, as Levi-Setti has shown, for these designs to work underwater where the trilobites lived, the lower lens was necessary. Thus, the trilobites 450 million years ago used an optimal design which would require a well trained and imaginative optical engineer to develop today — or one who was familiar with the seventeenth century optical literature.

Most fossils are not as easily understood as this. We have no idea why most structures in extinct organisms look the way they do. And, as I have already noted, different species usually appear and disappear from the record without showing the transitions that Darwin postulated.

Darwin's general solution to the incompati-

bility of fossil evidence and his theory was to say that the fossil record is a very incomplete one — that it is full of gaps, and that we have much to learn. In effect, he was saying that if the record were complete and if we had better knowledge of it, we would see the finely graduated chain that he predicted. And this was his main argument for downgrading the evidence from the fossil record.

Well, we are now about 120 years after Darwin and the knowledge of the fossil record has been greatly expanded. We now have a quarter of a million fossil species but the situation hasn't changed much. The record of evolution is still surprisingly jerky and, ironically, we have even fewer examples of evolutionary transition than we had in Darwin's time. By this I mean that some of the classic cases of darwinian change in the fossil record, such as the evolution of the horse in North America, have had to be discarded or modified as a result of more detailed information — what appeared to be a nice simple progression when relatively few data were available now appears to be much more complex and much less gradualistic. So Darwin's problem has not been alleviated in the last 120 years and we still have a record which *does* show change but one that can hardly be looked upon as the most reasonable consequence of natural selection. Also the major extinctions

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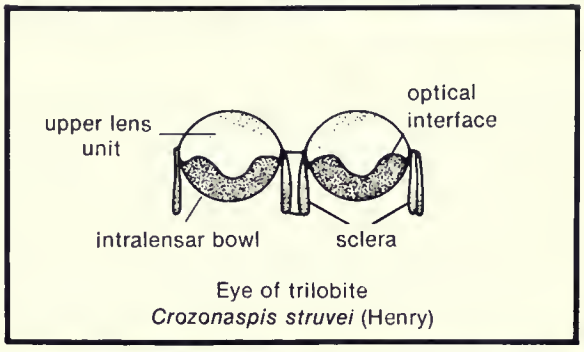
R. Levi-Setti




Eye of trilobite
*Crozonaspis struvei* (Henry)

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R. Levi-Setti

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R. Levi-Setti. Copyright © 1975 The University of Chicago

such as those of the dinosaurs and trilobites are still very puzzling.

Now let me step back from the problem and very generally discuss natural selection and what we know about it. I think it is safe to say that we know for sure that natural selection, as a process, does work. There is a mountain of experimental and observational evidence, much of it predating genetics, which shows that natural selection as a biological process works. Darwin's strongest evidence for selection actually came from the experience of plant and animal breeders who were employing artificial selection to produce evolution by breeding. And selection, be it natural or artificial, can clearly lead to better adapted types through a series of generations and through gradual transformation of a population.

So natural selection as a process is okay. We are also pretty sure that it goes on in nature although good examples are surprisingly rare. The best evidence comes from the many cases where it can be shown that biological structures have been optimized — that is, structures that represent optimal engineering solutions to the problems that an

animal has of feeding or escaping predators or generally functioning in its environment. The superb designs of flying reptiles and of trilobite eyes are examples. The presence of these optimal structures does not, of course, prove that they developed through natural selection but it does provide strong circumstantial argument.

Now with regard to the fossil record, we certainly see change. If any of us were to be put down in the Cretaceous landscape we would immediately recognize the differences. Some of the plants and animals would be familiar but most would have changed and some of the types would be totally different from those living today. The average duration of a species on the earth is less than 10 million years. And the record of really abundant life goes back at least 600 million years, so there has been complete turnover in the biological world many times. This record of change pretty clearly demonstrates that evolution has occurred if we define evolution simply as change; but it does not tell us how this change took place, and that's really the question. If we allow that natural selection works, as we almost have to do, the fossil record doesn't tell us whether it was responsible for 90 percent of the change we see, or 9 percent, or .9 percent.

*"The average duration of a species on the earth is less than 10 million years. And the record of really abundant life goes back at least 600 million years, so there has been complete turnover in the biological world many times."*

The very obvious question at this point is: what alternative mechanisms do we have to explain the changes that we observe? A great many alternatives have been suggested both before and after Darwin. Some of the evolutionary theories that have been proposed belong to the lunatic fringe, but others are serious propositions by competent scholars. A currently important alternative to natural selection has to do with the effects of pure chance. It has been suggested that there are traits which are not important enough to the organism to be "seen" by natural selection, and that a purely random system of evolution could work for these traits. Let me give an example which may be important in the fossil record: Many organisms have shells which are coiled in a spiral fashion, such as snails, the pearly nautilus, and a great many other fossil and living organisms. Sometimes the spiral is left-handed, sometimes it's right-handed. One is just the mirror image of the other. In most cases, whole species of snails are either exclusively left-handed or exclusively right-handed. In a few cases, both left-handed and right-handed forms occur within the same species. And it is pretty clear that this is a hereditary trait — although the genetic mechanism is often complex.

In most cases, it's difficult to find an advantage the left-handed form would have over the right-handed form, or vice-versa. In such cases, the coiling direction that dominates the species may just be a matter of chance; that is, the one that got there first, or happened by chance to have more offspring gradually came to dominate the population. This is the sort of trait that might be subject to random evolution — a clear difference between animals but one not seen by natural selection because it does not affect the general life and hard times of the organism. I should add that in some snails it has been shown that this situation is a little bit more complicated because copulatory behavior is affected by coiling direction; specifically, the left-handed ones get along better with other left-handed ones than with shells of opposite coiling direction. This gives a selective advantage to homogeneity in a population without giving preference to left or right. So a left-handed strain that got started might be aided by natural selection even though its origin was a matter of chance. In the general case, however, the symmetry difference is probably neutral.

It would seem that if evolution of shape and form in animals were a random affair, the result would be one of chaos. This, of course, is one of the major counter-arguments to the idea of random evolution (or random walk evolution as it is sometimes called). It is certainly true that one would be most unlikely to develop a functioning flying insect, reptile, or bird by a chance collection of changes. Some sort of guidance is necessary. And in these cases, of course, natural selection is the only mechanism we know of to produce a workable combination of characteristics. On the other hand, it may be that a great many of the differences that we observe within major animal groups are differences which do not have much effect on fitness. We are thus talking about the survival of the lucky as well as the survival of the fittest.

A large number of evolutionary biologists these days are studying the question that I've just considered — it's called neutral or nondarwinian evolution. Much of this research is concentrated in the Chicago area. Most of the work so far has been done with proteins of relatively minor importance in the biological scheme where the case for selective neutrality can be made much more easily. Paleontologists have to work with obvious traits,

and therefore, traits which are more likely to be seen by natural selection, so paleontologists are working at a scale different from that used by biologists. The whole problem of neutral evolution represents a very exciting area and is one of the most hotly debated topics in evolutionary biology today.

I would like now to concentrate on just one aspect of the problem. This has to do with the extinction of large groups such as the dinosaurs, the trilobites, and also somewhat smaller groups such as the flying reptiles that I have already discussed.

We know that the dinosaurs went extinct about 65 million years ago and we know they went extinct rather suddenly. Now, when we say the dinosaurs went extinct we are saying that a couple of prominent reptilian orders died out at about the same time. It is important to remember that what taxonomists call a class or an order does not exist as such. It's an abstraction denoting a collection of species descended from a common ancestor. It is an abstraction just as a family name in a human community is an abstraction. Therefore, when we say the dinosaurs went extinct what we are actually saying is that the dinosaur species living at a certain time didn't leave any descendants which we would call dinosaurs. The conventional wisdom is that the dinosaurs must have had traits in common or requirements in common such that they couldn't cope with changes in environment. And paleontologists have gone to great lengths to try to find out what happened.

Conventionally, the approach is a completely darwinian one based on the faith or belief that extinction can only be explained by finding some sort of Achilles heel shared by all members of the group. Along with this is the strong implication that the successor group — mammals in the dinosaur case — was somehow better than the dinosaurs, and this implies that if both were living today, the dinosaurs would again lose out to the mammals. This scenario may be true, but it is a very difficult one to prove. We don't have any convincing arguments for why the dinosaurs died out. It has even been suggested that we have a tendency to make what can only be called a *moral judgement* in cases of extinction. If a group went extinct, it must have been bad. The good prosper, the bad die.

What I would like to develop is an idea based on chance or randomness which may lead to the conclusion that the dinosaurs were simply unlucky. One way to approach this is to look at a completely different but analogous situation: one having to do with the evolution of surnames in human families. We know that family names die out. Surnames disappear from our communities. And the same question could be asked of them that is asked of the dinosaurs — does a human surname die out because its members are weak, or do something wrong, or does the family just have bad luck?

*"It was clever of the pterodactyls to think of flying, but that's all you can say for them. They were doomed from the start because they had no feathers and no wishbone, or furcula, as flying vertebrates should have. They didn't belong in the picture and public opinion was against them. The Archaeopteryx was not much of a bird, but at least it had feathers. As for the pterodactyls, the best thing to do is just forget them. Bats are going to flop, too, and everybody knows it except the bats themselves."* — How to Become Extinct, *by Will Cuppy (1941)*

One reason to turn to the evolution of surnames for help is that the subject has been worked on extensively for about 150 years and several effective mathematical techniques have been developed for working with the problem.

One of the first references to extinction of family names is found, of all places, in Malthus — in his famous *Essay on Population*. We normally associate Malthus with birth and population growth rather than death and extinction. But he mentioned in passing some data on the extinction of families in the town of Berne, Switzerland. He noted that over the 200-year period from 1583 to 1783, fully three-quarters of the prominent families that were present at the start of the period went extinct before the end of the 200 years. This was a startling figure. The same phenomenon was found later in other situations — including the English peerage and various European royal families. Wherever information was available, it showed that the average life expectancy of a family name is surprisingly short. This was intuitively unreasonable. Because all the data came from the upper classes of society, it was assumed that there was something debilitating or weakening about membership in the upper classes — and this gave rise to all sorts of sociological theory and speculation. But these speculations could not be checked because information was not available for the lower classes of society.

It turned out, after some now classic mathematical analysis by Galton and Watson* that what Malthus and others had observed was exactly what should be expected by chance alone, and the social class had nothing to do with it! This was later confirmed by studies of whole communities.

What this means is that families are inher-

*F. Galton and H. W. Watson, 1875, "On the Probability of the Extinction of Families," in the Journal of the Anthropological Society of London, *Vol. IV, pp. 138-44.*

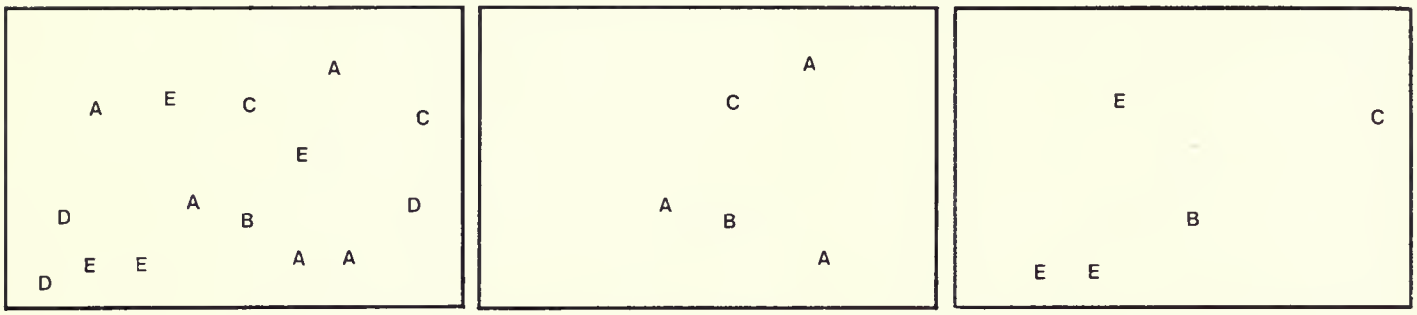
ently prone to extinction even though the population as a whole is stable — or even growing. Now this is still counter-intuitive and hard to accept. We all know of families that are enormous and which have long histories. The biography shelves of any library are full of examples. But the fact is that the ultimate extinction of any family name is statistically inevitable. The only uncertainty is *when*. It is perhaps best understood by noting that a family has about an equal chance of increasing or decreasing in size during a single generation. This is because the chances are about 50-50 of any marriage producing a male heir unless, of course, the couple keeps having children for the express purpose of having a male heir. I must apologize for my emphasis on the male line but since it is the name-bearing line, it is easier to work with. The same results can be gotten with the female lines but it is less convenient to analyze. Anyway, the number of males in a family fluctuates up and down as a random walk. If the number happens to drop to zero, the family is, so to speak, out of the game. The surname is extinct and cannot recover. But there is no such limit on the high side. That is, success cannot guarantee immunity to extinction to the degree that extinction guarantees immunity from success. Thus, ultimate extinction is inevitable and the smaller a family, the greater the chances of its becoming extinct in the next generation. Most families die out quickly because they generally start out small and thus are dangerously close to extinction at the beginning. Most published family histories are written about those families which do survive to become large. And most family histories are written by family members and thus are about families that have not yet become extinct. The biography shelves of a library thus contain a most unrepresentative sample of families. And even these families are doomed in the long run by the random walk nature of family evolution.

For the reader who is still skeptical, I recommend any of the published catalogs of the English peerage. The English peerage provides a particularly clear-cut situation. When a single individual is declared to be a peer of England, with the title to be inherited through the male line, we have the start of what is, in effect, a new family with a single founder. Some lines last a long time but most disappear in the first one, two, or three generations.

A good example of such disappearance is that of the earldom of Rochester. Henry Wilmot was declared the First Earl of Rochester in 1652 but died seven years later leaving one son, John, who became the Second Earl. John died 21 years after that and *his* only son died as a child and the title became extinct. Now all three earls died of specific causes — John died of syphilis for example. One can say that John was unlucky, but the extinction of the line cannot be said to have happened without cause. *But* if we look at a whole group of such families, their histories are indistinguishable from a system controlled only by chance. By assuming a system of chance, we can accurately predict the approximate number of families that will be short-lived — even though we cannot predict in advance which families will be short-lived.

Now, suppose we have an imaginary human community which has a variety of surnames. Most of the families will be small — either because they just started or because they are on the verge of extinction. Only a few families will be large. This imaginary community would have a telephone book much like that of Chicago in the sense that a few names are very abundant but most are not. Now suppose that the population were suddenly reduced by epidemic disease. And suppose that family affiliation was not a factor in the reduction: that is, assume that Smiths were not more susceptible to disease than Browns. If this were to happen, there would be simultaneous extinction of many families. Most of the disappearing families would be the small ones but some large ones would be included. If someone were to look at family records later, it might *appear* that the reduction in population size was due to extinction of families — rather than the other way around — and one might be tempted to search for common denominators of failure among the families that died out in order to find out *why* they died out. But this would be entirely wrong because surname extinction was the effect rather than the cause of the population drop.

I can illustrate the general principle by a hypothetical example. The left side of *Figure 8*, above, shows a random array of 15 letters —ranging from *A* to *E*. Each letter may be thought of as representing a different surname; *A* is the most common and *B* the least common. Now, if we remove letters randomly, we may get something




*8*

like the middle of *Figure 8*. Ten letters were selected for removal by using a table of random numbers. The letter *A* survived which is not surprising because it was the most common to begin with. But *B* also survived — by good luck. *D* and *E* went extinct. The right side of *Figure 8* shows another try with the same original pattern. This time, *A* and *D* went extinct and *B*, *C*, and *E* survived. *B* was lucky both times.

Let me return now to the fossil record of evolution. The dinosaurs died out at the end of the Cretaceous period (about 65 million years ago). Several other important animal groups also died out at about the same time. The groups seem to have little in common. Some lived on land, others in the sea. Some were large animals, some were small. And so on. (There is nothing surprising, by the way, in the fact that all these groups died out near the boundary two periods in the geologic time scale because the boundary itself is defined on the basis of the extinctions.) Many paleontologists have spent years trying to figure out what failing was shared by such different animal groups. Some explanations have been suggested but none of them is really convincing (to me, at least). The only thing we know for sure is that a lot of groups died out at about the same time. The fact of the extinctions is not geologically unusual — only the number of extinctions in a short time.

The business about extinction of human surnames may provide a solution. We may postulate that the end of the Cretaceous period was a time when an unusually large number of species died out. This could have resulted from some sort of epidemic, or a worldwide change in climate, or from a rare astronomical event. If a lot of separate species died out, some families and orders would inevitably also die out, as we have seen through the surname analogy. Some species would survive by luck and some would survive because they were fit. But these differences in fitness need not have anything to do with membership in a group such as reptiles and mammals.

Thanks to the mathematical techniques developed by people working with surnames, it is possible to test the geologic case against the proposition that species extinctions are not biased by the group to which the species belongs. It turns out that tests of several mass extinctions in the fossil record show that group membership (family name, if you will) is not statistically correlated with the extinctions. The dinosaur extinctions have not been fully tested yet. But experience with other extinction events leads one to look at the dinosaur extinctions as a possible chance phenomenon. It may be that the mammals were not better than the dinosaurs but just luckier at a time when an unusually large number of species were dying. This leads to the rather disquieting conclusion that if the Cretaceous extinctions were to be reenacted, a different suite of groups might have survived and this suite might not include our ancestors.

The ideas I have discussed here are rather new and have not been completely tested. No matter how they come out, however, they are having a ventilating effect on thinking in evolution and the conventional dogma is being challenged. If the ideas turn out to be valid, it will mean that Darwin was correct in what he said but that he was explaining only a part of the total evolutionary picture. The part he missed was the simple element of chance!

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BORDEN EXPEDITION

*Continued from p. 8*

The Museum's *Annual Report* for 1927 carried this description of the zoological specimens collected:

". . . The zoological results of this expedition include a . . . group of Peninsula Brown Bears (*Ursus dalli gyas*) which are the largest carnivorous animals now living, rivalling in size the Cave Bear of Pleistocene times. Of the four specimens selected for a group, two were shot by Mrs. John Borden, one by Miss Frances Ames, and the fourth, . . . by Mrs. R. B. Slaughter. The expedition also obtained . . . Polar Bears and the complete skin and skull of a large male Pacific Walrus, . . ."

Five of the eight Sea Scouts survive today: Andrews, Purcell, Carstenson, Ram and McClelland. Andrews, who became an engineer, and Carstenson, who became a tool and die maker, are living in Florida. Ram, the only scout to become a professional mariner, is with the merchant marine. Purcell, a Jesuit priest, is a research professor at Georgetown University and a distinguished industrial labor relations authority. McClelland, a Chicago resident, is a retired physics teacher. Shortly after the expedition, McClelland made a name for himself by skippering the winning schooner, *Blue Moon*, in the 1929 Chicago-Mackinac yacht race.

Frances Ames, who collected botanical specimens on the expedition, is now Mrs. Douglas Wolseley, of Santa Barbara, CA. Mrs. Charles B. Goodspeed, widowed and remarried, is now Mrs. Gilbert W. Chapman, of New York. Mrs. John Borden (née Courtney Letts), subsequently wife of the Argentine ambassador to the United States (1931-43), Felipe Espil (deceased), is now Mrs. Foster Adams, of New York. Mrs. Adams will be at Field Museum on Saturday, February 3, to introduce the film "The Cruise of the Northern Light," which will be shown in James Simpson Theatre. □

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*prepared by* KENNETH GRABOWSKI

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Jivaro: Dec. 2
John G. Searle Herbarium: March 3
Johnson, Capt. I.: Feb. 18
Johnson, R. G.: Feb. 10; Sept. 16, 26
Johnson, R. K.: Feb. 19; June 3
Jones, K.: May 26
Jones, M.: March 12
Jones, W.: March 4
Joseph N. Field South Pacific Exped. of 1909-1913: May 4-8
Joseph, W. F.: Nov. 8
"Journey into the World of Money" (program): Sept. 28
Judson, M. (Mrs. R. D.): June 5

*kacapi:* Jan. 7
Karamanski, T.: Nov. 6
Karisimbi volcano: April 7
*kasekten:* Jan. 5
Kellog, J. L.: June 5
Kellogg Trust, Helen L.: June 4
*kempul:* Jan. 4, 9
*kendang:* Jan. 6
Kennedy, J. (Mrs. R. L.): June 5
*kenong:* Jan. 4, 10
Kent, L.: Jan. 17
Kerkhoven, E. J.: Jan. 7
Kersh, I.: Sept. 14
Kethley, J. B.: June 3
*ketuk:* Jan. 10
Keynes, Q.: Feb. 18
King Cove: Nov. 21
King Tutankhamun Exhibit: Jan. 10b; May 3; Sept. 5; Oct. 3
Klein, L.: Sept. 3
Klaune Ntnl. Park: Feb. 15
Koeppen, R. C.: Jan. 15
Kolar, Janet: Sept. 2
Kolar, John: Sept. 2; Oct. 2; Nov. 2
Kolata, A. L.: July/Aug. 4
Kondo, Y.: Nov. 16
Korbecki, J. A.: Nov. 26
Kraglievich, J. L.: Oct. 8
Kraus, D. H.: Feb. 19
Kroc, Mr. and Mrs. R. A.: May 3
Kuang Hsu: Nov. 10
Kudu: Nov. 28
Kukailimoku: Dec. 2
Kulik, L. A.: Sept. 11
Kummel, B.: Sept. 3
Kutkuhn, J. H.: Oct. 25
Land and Water Conserv. Act: Oct. 5
"Land of the Rio Grande" (program): Feb. 27
Langford, G.: Sept. 23, 25
Lansdowne, J. F.: Nov. 3, 28
Lao Chun: June 20
Lao Tzu: June 20
L'Argentiere-la-Bessee: Feb. 14
Late Woodland culture: April 19
Laufer, B.: June 16-18, 22; Nov. 10, 14
lead poisoning, waterfowl: Feb. 15
lechwe, black: Oct. 23
"Leon Mandel 1941 Zoological Exped. to the Galapagos" (program): Nov. 27
Leonard, A.: March 12
leopard: Oct. 23
Lerner, C.: May 26
Lesquereux, L.: Sept. 22
Levy, A.: Oct. 18
Lewis, A. B.: May 5-9
Lib. of Cong.: Jan. 6
Lietz, W.: Jan. 6
*Life in the Pre-Columbian Town of Galindo, Peru* (article): March 16
Link, C.: April 2
Linnaeus, C.: April 23
lion: April 8; Oct. 23
Litton, M.: Oct. 26
Livingston, J. A.: Nov. 3
Livingstone, D.: April 6
locks, Iranian: June 5
"Locks from Iran: A Key to Culture" (exhibit): April 27
Lomax, A.: July/Aug. 21
Longard tube: Oct. 22
Lor: July/Aug. 1
"Lords of the Labyrinth" (program): Feb. 27
Los Angeles County Mus. of Art: April 14
Lund, R.: Feb. 19

MacDougall, D.: July/Aug. 16, 20
MacElvane Pit: Sept. 25
Madesen, B.: Oct. 26
*Male and Female: Anthropology Game* (article): April 12
Malle, L.: July/Aug. 20
Mammoth Hot Springs: Nov. 4
Mandel, L.: Nov. 27
Manicouagan-Mushalagan Crater: Sept. 9, 13
*maria basin:* Sept. 13
Marshall Field Palaeontological Exped. to Patagonia (1922-24): March 4-11; May 16-23
Marshall, J.: July/Aug. 19
Marshall, L. G.: March 4, 11; May 2, 16; Oct. 6; Nov. 26
Martin, H. T.: March 6
Martin, R. E.: Jan. 10b
Martling, M.: March 13
Marx, H.: Feb. 19
Matthew, H. M.: Jan. 10b
*Mazon Creek Census* (article): Sept. 15
Mazon Creek fossils: Sept. 15-18, 20-26
*Mazon Creek Studies: The First 120 Years* (article): Sept. 22
Mbira music, African: Nov. 28
McClelland, K.: Nov. 7
McCrone, W. C.: Jan. 15
McVey, J.: Oct. 24
Mead, M.: July/Aug. 18-19
Mech, D.: July/Aug. 9
"Mediterranean: East to Istanbul" (lecture): Feb. 18
Meek, F. B.: Sept. 22-23
*Megatherium:* May 19
Mellema, R. L.: Jan. 15
Mellinger, M.: April 10
memorial fund, Field Museum: May 25
Mendez, F.: Oct. 6, 9
Mendez, J.: Oct. 6, 9
Mentes, M.: Oct. 26
Mentes, S.: Oct. 26
mercury poisoning: Nov. 5
metallophone, gamelan: Jan. 5, 8-9, 11
meteorites: Sept. 6-13
"Mexico: Legend of a Lost Crown" (lecture): Feb. 18
Meyers, H.: Feb. 18
Meyers, L.: Feb. 18
Middlefork River: April 20
Milulic, D. G.: Feb. 19
Minn. Dept. Nat. Res.: July/Aug. 9
Mississippi waterbirds: June 14
Mo. Dept. Conserv.: Feb. 15
moa: Oct. 12
Moche: Feb. 4, 8, 17, 20, 25; March 16-23; July/Aug. 4
"Moche: Ancient Peru's Mastercraftsmen, The" (lecture): Feb. 17
Moche Valley: March 16-23; July/Aug. 4-8
monkey: April 8, Oct. 23
Montagnais-Naskapi Indians: June 11
Moodie, R.: Sept. 23
Moore, O. K.: June 11
Moran, L. H.: Nov. 26
Moran, M. A.: Nov. 17
Moran, R.: March 25
Morin, E.: July/Aug. 20
Morris, C.: Feb. 16
Morris, R.: June 12, 14
Moseley, M.: Feb. 9, 16, 22
Moses-in-the-cradle (oyster plant): April 23
Mt. McKinley Nat. Park: Feb. 15
Mt. Meru: Jan. 8
Mt. St. Elias: Feb. 15
Mt. Vesuvius: Nov. 26
Moyer, J.: Feb. 12
Muller, L.: March 13
Mullen, M. F.: Sept. 3
Mundt, G. C. F. W.: Jan. 6
*munggang:* Jan. 5
Museo Oro del Peru: Feb. 2-3
Museum für Volkerkunde: May 5
Mus. of Cult. Hist.: Feb. 17

Nabokov, P.: Nov. 26
Nadler, N. (Mrs. C. F.): June 5
Nagle, C.: Feb. 18
Naples Nat. Mus.: Nov. 26
Nastapoka Islands Arc: Sept. 9, 13
Nat. Acad. of Sci.: May 12, 25
Nat. Endowm. for Arts: Jan. 2, 6, 10b, 13
Nat. Fish, Wildlife Lab.: March 26
Nat. Geog. Soc.: Nov. 26
Nat. Mar. Fisheries Serv.: June 15; Oct. 24
Nat. Oil Recycling Act: June 13-14
Nat. Park Serv.: Oct. 24
Nat. Park Syst.: Feb. 15
Nat. Sci. Found.: Nov. 18

Nat. Wild, Scenic Rivers Syst.: Feb. 15
Nat. Wildl. Fed.: April 10; May 10, 25; June 12, 14; Oct. 23, 25
Nat. Wildlife Health Lab.: Feb. 15
Nat. Wildl. Ref. Syst.: Feb. 15
Native American Program: Jan. 10b
*Natural History Quiz* (article): July/Aug. 15
Nazca: Feb. 9
Nevling, L. I.: Jan. 10a; April 3; June 3
Newberry, J. S.: Sept. 23
New Guinea: May 4-8
*New Guinea Adventure: Sketch of a Working Anthropologist* (article): May 4
New Quebec Crater (Chubb Crater): Sept. 8-10, 12
Newton, E.: March 13
1976 UA (asteroid): Sept. 6, 8
Nitecki, M. H.: Feb. 19; Sept. 22
Noe, A.: Sept. 23
*Northern Light* (ship): Nov. 6
Northwest Coast Indian basketry: Jan. 10b
Northwestern Univ.: Jan. 10b
Nyamuragira Volc.: April 7-8
Nyiragongo Volc.: April 7

O'Brien, J.: March 12-13
OCLC (library computer): June 3
O'Connor, J. J.: March 3; May 3
octopus: March 26
Ohio College Libr. Cent.: June 3
oil crisis: June 12-14
"Ojos de Dios" (God's Eyes): Sept. 14
Okefenokee: July/Aug. 9
Olsen, E. J.: Sept. 6
"Orchestral Ensembles of China, Thailand, and Indonesia" (program): Oct. 27
oribi: Oct. 23
Oriental Inst.: Oct. 3
Osaka Garyo-Kai: Sept. 28
Osterburger, L.: Sept. 18
"Outback Australia" (lecture): Oct. 26
Ovrut, B. A.: April 4
Ovrut, S.: April 4
Owen, R.: May 21
oyster plant (Moses-in-the-cradle): April 23

Pachakuti: Feb. 22
Pacific Island snails: Nov. 16-19
Padnos, A.: March 13
Padre Isl.: Oct. 24
Painted Desert Nat. Mon.: March 11
Paleontological Soc.: Sept. 20
Panjan, T. A.: Jan. 10b
paper cutout, Chinese: April 1-2
"Papua New Guinea: Twilight of Eden" (program): Jan. 19
Paris Mus. of Nat. Hist.: March 6
Parker, S. B.: May 4
Patagonia: March 4-11
Patterson, B.: Feb. 19; Oct. 8, 10, 14
Paul, R. C.: Feb. 19: Nov. 16
Pawnee Earth Lodge: Jan. 10b; Oct. 16-21
Peabody Museum: Jan. 6; Feb. 3; March 16
Peacock, E.: Jan. 16-17
peat: July/Aug. 10
*peking:* Jan. 9, 11, 18
Pelliot, P.: June 16
Peppers, R.: Sept. 25
peregrine: Oct. 5
Perenyi, T.: June 3
Perrault, P.: July/Aug. 13
Peru's Golden Treasures: Jan. 10b; Feb. 1-11, 16-17, 20-26; March 3; April 3
*Peru's Golden Treasures* (article): Feb. 3
Peru's Golden Treasures Lecture Series: Feb. 16-17
"Peruvian Music Performance" (program): Feb. 27
Peruvian tour: Feb. 9
Peters, G.: April 20
Petrified Forest: March 11
Petrunkevitch, A.: Sept. 23
Pfefferkorr, H.: Sept. 25
Phillips, T.: Sept. 25
pigeon, carrier: May 11
pigeon, homing: Nov. 5
Pit 11 (Mazon Creek): Sept. 15, 17-18, 21-22, 24-25
Pitts, A. H.: June 24
Pizarro, F.: Feb. 3
Plains Indians: Dec. 3
poaching: Oct. 23-24
Podkamenaia Tunguska River: Sept. 10
poisoning, waterfowl lead: Feb. 15
"Poland" (lecture): Oct. 26
Pola de Ayala, F. G.: Feb. 3
"Policy Statement of F. M. on Antiquities: May 9
pollution, air: April 11
Pomerantz, L.: Jan. 6, 13
Pomo Indians: Dec. 3
Pontynen, A.: June 16
"Potato Planters" (program): Feb. 27
pot gong: Jan. 3
Poulson, T. L.: June 3
Power, J.: Nov. 7-8
Pozorski, S.: July/Aug. 7
Pozorski, T.: July/Aug. 7
Pratt, D.: March 26
Pray, L. L.: Oct. 13
*Prehistoric Missionaries in East Central Illinois* (article): April 16
Pribilof Islands: Nov. 22
Princeton Univ.: March 6
Pritchard, P.: Oct. 24
Programa Riego Antiguo: July/Aug. 4-8
Puerta de Corral Quemado: Oct. 7-8, 10-11
"Puerto Rico" (lecture): Oct. 26
puppet play, Javanese: March 25
Purcell, T.: Nov. 7-8
P'u-Yi, H.: Nov. 10

Quetico Wilderness canoe trip: April 26
Quinn, J. H.: Feb. 12-13, 19; May 23

Rabb, G. B.: Feb. 19
Rabineau, P.: Dec. 1-3
Rada, Col. M. E.: Nov. 27
"Rails of the World" (exhibit): Nov. 3
Ram, S.: Nov. 7-8
Rancho Nuevo: Oct. 24
Ransom, J. H.: March 3
Raup, D. M.: Sept. 3
*rebab:* Jan. 4-6
*Red October* (ship): Nov. 23
Reed, C. A.: Feb. 19
Rehling, A.: May 24
*Restoration of the Gamelan* (article): Jan. 13
Reykjavik (Iceland): Nov. 4
rhinoceros, prehist.: Feb. 13
Rich N. (Mrs. J. E.): June 5
Richardson, E. S.: Feb. 19; Sept. 16, 22, 25
Richter, K.: Feb. 18
Riggs, E. S.: March 4, 6, 11; May 2, 16; Oct. 6, 14; Nov. 26
Riley, T. J.: April 16; June 6
Rio Moche: March 17, 22
Ripley, S. D.: Nov. 3
Roberts, J. W.: Oct. 26
Roman art: Nov. 26
Rouch, J.: July/Aug. 19-21
*Royal Burials of Ancient Peru* (article): Feb. 6, 21
Royal Imp. Mus.: Sept. 23
Royal Ontario Mus.: Sept. 8
Royal Trop. Inst.: Jan. 15
rubber: May 11-12, 25; July/Aug. 10
Runnells, J. S.: March 3
Rutshuru River: April 6
Ruwenzori Mts.: April 5-6
Rwindi River: April 6
Ryan, J.: Nov. 7-8

Sabaro, M.: June 20
Sabatini and Sons: Nov. 26
Sack, S.: June 13
Sakai, S.: Feb. 14
salmon, Atlantic: June 15
*Salmonella:* March 26
salt bag, Bakhtiari: July/Aug. 2, 24
salt bag, Lor: July/Aug. 1-2
San Bernardino Mts.: March 11
San Diego Mus. Nat. Hist.: Sept. 26
Santa Cruz Formation: March 6, 9
*saron:* Jan. 4, 8-9, 11, 14
scapulamancy: June 11
*Scelidotherium:* May 1-2, 21
Schneider, A.: March 12
Schram, F. G.: Sept. 26
Schueppert, S.: March 13
Schultze, H.-P.: Feb. 19
Schumacher, C.: March 13
"Scotland" (lecture): Oct. 26
Scudder, S. H.: Sept. 23
seal, harp: May 10-11
Searle Herbarium, John G.: March 3
Searle, J. G.: March 3
Searle, W.: March 3
Second Marshall Field Paleontological Expedition to Argentina: Oct. 6-15
seismograph: July/Aug. 4-8
Semantics Symposium: June 3
Semliki River: April 7
Senosastroamidjojo: Jan. 8
Sewell, J.: May 9
Shabanou of Iran: April 27
shadow play, Javanese: March 25; Sept. 14
Sharpe, Sir A.: April 7-8
*Shell Makers: Introducing Mollusks, The* (book): Nov. 19
Sherwin-Williams Co.: Jan. 17
Silverman, D.: Oct. 3
Siren, O.: June 18
Skiff, F. J. V.: May 5
Slaughter, R. B.: Nov. 9, 21
Slaughter, Mrs. R. B.: Nov. 9, 20
*slendro:* Jan. 5
Smith, E. B.: March 3
Smithsonian Inst.: Feb. 12
snail: Nov. 16-19
Society of Typographic Arts: Sep. 3
Sohn, I. G.: Feb. 19
Soil Conserv. Serv.: May 11
soil erosion: May 11
Solem, A.: Nov. 16
*Solem and Snails* (article): Nov. 16
"Soul of Japan, The" (lecture): Feb. 18
sparrow, house: March 26
"Spell of Ireland, The" (lecture): Oct. 26
Spelliscy, S.: June 15
Spicehandler, J.: Jan. 16
spider fossil: Sept. 17

spiderwort: April 23-25
*Spondylus* (mollusk): Feb. 10
Stahlecker, R.: Oct. 6, 9
"Stamp Sampler: Postage from Natural History" (exhibit): Nov. 27
Stanford, J.: Feb. 15
Stanley, H.: April 5
Stanley, S. M.: Sept. 3
"Stationary Ark, The" (program): July/Aug. 23; Sept. 4
Stein, L.: March 13
Stein, M. A.: June 16
Sternberg, G. F.: March 4, 8-9, 11
Stevenson, A. E.: Nov. 6
Stohler, R.: Nov. 16
Stolze, R. G.: Feb. 19
Stoner, B.: March 4
Story, M.: March 13; April 12
Straus, M. (Mrs. R. E.): June 5
Strong, S. S.: Sept. 22
Strucco, J.: May 1-2, 17, 20
Stuessy, T. F.: Feb. 19
Sulek, J.: Oct. 3
*suling:* Jan. 7, 12
Sullivan, J. W.: March 3
Suminta Mein, Pak: Jan. 5
Superior Nat. For.: July/Aug. 9
swamp fire: July/Aug. 9
Swanson, J.: May 26; July/Aug. 16
Swartchild, J.: March 2, 12
Swartchild, Jr., W. G.: March 3, 12; May 3
Swearingen, Mrs. R. O.: June 5
Swift, C. (Mrs. E. F.): June 5
Sylvester, W.: Oct. 26

tabasco sauce: Oct. 5
Tahitian bridal veil (plant): April 23
"Tahuantinguyo Music of the Andes" (program): May 27
Taiei Company Ltd.: Nov. 5
Takahashi, Y.: March 24
Talbot, P.: March 12
*tarawangsa:* Jan. 7
Tarija: May 16-17, 22
Taylor, K.: Feb. 19
teak, Thai: Nov. 5
*Telea polyphemus:* March 1
*Teleoceras fossiger:* Feb. 13
Tenn. Val. Auth.: July/Aug. 10
Terrell, J.: Feb. 19; May 26
*Terror Bird, The* (article): Oct. 6
terror bird (*Andalgalornis*): Oct. 6
Testa, R.: Jan. 3, 10a; June 4; Dec. 1-3
Texas Parks, Wildl. Dept.: Oct. 24
Thevenin, A.: May 17
Thomas, H. (Mrs. R. L.): June 5
Thompson, D. H.: June 14
Thompson, I.: Feb. 19
Thorne, R. C.: May 19-20, 22; Oct. 6, 9
threatened species: July/Aug. 3; Oct. 4
"Through Cloud and Eclipse" (Javanese shadow play): March 25
*Thumbelina: House Guest in Miniature* (article): April 22
Tibet: June 16
Tieken, Mrs. T.: March 3
T'ien Tsun: June 20
Tiffany, L.: June 2
Tiffany window: June 1-2
Tikopia: April 18-19
Tilghman N.: Oct. 5
tires, recycled: July/Aug. 10
"To and Fro: Migration of North American Animals" (program): June 23
Tongass Nat. For.: Feb. 15
"touch bone" (dinosaur femur): March 8, 11
Tournouer, A.: March 6
toxodont: May 21
Traylor, M. A.: Jan. 10a
"Treasures Lost" (lecture): Feb. 16
"Treasures of Italy" (lecture): Feb. 18
*Triloka:* Jan. 8
Truffaut, F.: July/Aug. 20
Tsavo Park: Oct. 23
tsetse fly: April 7
Tully, F. J.: Sept. 25
"Tully monster": Sept. 18, 21, 25
Tunguska explosion: Sept. 9
Turnbull, W.: Feb. 13
Turner, R.: Jan. 10b
turtle, Atlantic ridley: Oct. 24
turtle, Ill. mud: Oct. 4
turtle, olive ridley: Oct. 25
turtle, Pacific ridley: Oct. 25
Tutankhamun Exhibit: Jan. 10b; May 3; Sept. 5; Oct. 3
Tz'u Hsi: Sept. 19

Unalaska Harbor: Nov. 22
U. of Amsterdam: Jan. 18
U. of Chicago: Jan. 10b; May 3, 9; Sept. 23, 25-26; Oct. 3
U. of Fla.: June 15
U. of Hawaii: April 14; May 9
U. of Kans.: March 6
U. of Minn.: March 26
U. of Ore.: Sept. 4
U. of Va.: Oct. 22
U. of Wis.: June 14
Urban, H.: Jan. 16-17; March 13
U. S. Army Corps of Engin.: Oct. 22
U. S. Dept. of Agric.: May 25
U. S. Dept. of Energy: June 13
U. S. Dept. of the Int. Geol. Surv.: Sept. 9
U. S. Fish and Wildl. Serv.: Feb. 15; April 10; May 11; June 15; July/Aug. 9; Oct. 4, 24
U. S. Forest Prod. Lab.: Jan. 15
U. S. Marine Mammal Protection Act: May 11
U. S. Nat. Geothermal Energy Res. Prog.: Nov. 5
Used Oil Recycling Prog.: June 13

Vanderstappen, H.: May 9
Vanik, C.: Feb. 13
VanStone, J. W.: Feb. 19
*Versatile Gourd, The* (article): May 24
Virunga National Park: April 4-9
Virunga volcanoes: April 6
*Virunga: Or Whatever Happened to Albert National Park?* (article): April 4
Vitshumbi: April 8
volunteers, Field Museum: March 12
von Beringe, O.: April 9
von Le Coq, A.: June 16
Voris, H. K.: Feb. 19; Sept. 3
Voyageur Wilderness Prog.: April 26
Vredefort Ring: Sept. 9-10

Wagener, A. P.: Jan. 17
Walter E. Heller Foundation: Jan. 2, 6
Walsten, D.: March 11; Nov. 6
wandering Jew (plant): April 23
warbler, Kirtland's: Oct. 5
Ward, J.: July/Aug. 14
Warner, L.: June 16
wart hog: April 8
waterbuck: April 8
Watson, D. M. S.: Sept. 23
Watson, O. M.: July/Aug. 14
Wauer, R.: Oct. 24
*Wayang Puppets, Carving, Coloring, and Symbolism* (book): Jan. 15
*wayang* shadow puppet play: Sept. 14
Weaver, B. L.: Oct. 3
weaving, nomadic: June 23
Webber, E. L.: March 3, 12
Weekend Discovery Prog.: Nov. 14
Weiss, B.: July/Aug. 14
Weiss, D.: March 12
Wells, J. (Mrs. R.): June 5
Wenzel, R. C.: Jan. 10a
Wertime, J.: July/Aug. 2
Wertime, S.: July/Aug. 2
Western Rift Valley: April 5
Westoll, T. S.: Sept. 23
Whipple, F.: Sept. 12
Whitmire, G.: April 26
Whittlesey Foundation: April 17
Wieser, Col.: Oct. 6
Wilcox, K.: April 10
wild dog: Oct. 23
wildebeest: April 8
Wildfowl Trust: Sept. 4
Wildlife Management Inst.: May 11
Willard, D. E.: June 3
Williams, P.: Nov. 16; Dec. 3
Williams, T. P.: Feb. 19
Willow Slough State Game Preserve: Sept. 1-2
"Winter Magic Around the World" (lecture): Oct. 26
Wisconsin Dept. Nat. Res.: Oct. 5
Witrock, R. B.: Sept. 3
Wodinsky, J.: March 26
Wolf Creek Crater: Sept. 9, 12
Wolf, G.: July/Aug. 19
wolf, gray: July/Aug. 9
Wolfe, J. G.: March 7-9
Wolfgang, K.: Feb. 18
Women's Board Officers, F. M.: June 5
Women's Board Presidents, F. M.: Sept. 3
woodpecker, red-headed: May 25
Woods, L.: Nov. 27
Woody, J.: Oct. 24
World Music Prog.: Sept. 14
World's Columbian Expstn. of 1893: Jan. 6-7, 13
Worthen, A. H.: Sept. 22-23
Wrangell Isl.: Nov. 23
Wrangell-St. Elias: Feb. 15
Wright, B.: July/Aug. 17

"xylophone," gamelan: Jan. 5, 7, 10
xylophone (true), gamelan: Jan. 4-5, 7-8

Yang Jen: June 22
Yarrington, B. J.: March 3
Yellowstone Nat. Park: Nov. 4-5
Yokoyama, Henry: May 25
"Yoruk: Nomadic Weaving Tradition of the Middle East" (exhibit): June 23; July/Aug. 1-2, 24
Yueh Lung Shadow Theatre: May 27
Yu-ho Ecke, T.: April 14; May 9

Zallinger, J.: Oct. 15
Zallinger, R. F.: Oct. 15
zebra, Grevy's: April 11
zebra, Hartmann's mountain: April 11
zither, gamelan: Jan. 5, 7
Zool. Soc. of London: Sept. 4

# *January & February at Field Museum*

(January 15 through February 15)

### New Exhibits

**Feather Arts:** Beauty, Wealth, and Spirit from Five Continents. Opens February 15. Conceived and created by Field Museum's own staff, this exhibit features exotic feather objects from around the world. Assembled almost entirely from in-house collections, "Feather Arts" will travel to three other museums nationwide after its four-month stay at Field Museum. The 260 artifacts, drawn from 1,000 years of history, include such rarities as an Hawaiian king's feather mantle which was given to George IV of England in 1821, and the feather shoes of an Australian sorcerer. This fascinating exhibit examines the symbolic and religious meaning of feathers over the centuries and illustrates the importance of featherwork as a universal art form. Hall 26. Through June 15. (Members' preview February 14, 1 to 7 p.m.)

**A Stamp Sampler: Postage from Natural History.** Opened December 8. This new exhibit unites 63 natural history specimens with samples of philatelic art. Planned on a rotating basis to cover the four disciplines of natural history, the first 8 months of the exhibit will be devoted to zoological specimens and their representations on stamps from all over the world. "A Stamp Sampler" was conceived by Field Museum volunteer Col. M. E. Rada, exhibit guest curator. The exhibition was designed by Peter Ho, a University of Illinois graduate student.

### Continuing Exhibits

**Rails of the World.** Through Jan. 28. An exhibition of 42 watercolors, painted by J. Fenwick Lansdowne, represents the little-known bird family of Rallidae. The exhibition is part of a national tour organized by the Smithsonian Institution Traveling Exhibition Service. A combination of art, science, and artistic realism, the works were painted to illustrate the book Rails of the World, by S. Dillon Ripley, secretary of the Smithsonian. Hall 21.

**The Hall of Chinese Jades** contains beautiful jade art spanning over 6,000 years of Chinese history. An exhibit in the center of the hall illustrates ancient jade carving techniques. Hall 30, second floor.

**Birds.** Exhibits in Halls 20 and 21 examine the varied world of birds, from the antarctic emperor penguin to the common American sparrow. Three scenes are devoted to Chicago-area birds. Recently extinct birds (e.g., the Mauritius dodo, the passenger pigeon) and restorations of fossil birds are also on view.

### New Programs

**Under Coyote's Eye: A Play about Ishi.** Sunday, Jan. 21, 2 p.m. Ishi, a Yahi Indian from a now extinct California tribe, emerged into Western society in 1911 and shared the lost art, mythology, philosophy, and songs of his culture with a modern world. The Other Theatre of the Bernard Horwich Jewish Community Center interprets Ishi's way of life. Admission: nonmembers $3.00; members, students with ID, $1.50. James Simpson Theatre.

**"The Cruise of the Northern Light,"** a one-hour film taken during the Borden-Field Museum 1927 Alaska Arctic Expedition. Saturday, Feb. 3, 1:30 p.m. Narrated by Rev. Theodore V. Purcell, S.J., who at 15, was the youngest expedition member. Unseen by the public for 50 years, this film documents the acquisition of valuable ethnological specimens, plants, birds, and mammals for Field Museum's scientific collections. Admission: $3.00; members, $1.50. James Simpson Theatre.

**The Galapagos—Las Islas Encantadas.** Saturday, Feb. 10. This illustrated lecture by J. de Navarre Macomb, Jr. looks at the natural wonders of the Galapagos Archipelago that influenced Darwin when he developed his theory of evolution. The physical terrain and wildlife of these fascinating islands are examined by experts in geology and Darwinian theory. Admission is free at the West Entrance of the Museum. 2:30 p.m. James Simpson Theatre.

**Courses for Adults, Winter Series.** Beginning January 16, the Museum offers a variety of noncredit, undergraduate-level courses in anthropology and the natural sciences. These courses, available to persons 18 years of age or older, include "Plants of the Great Lakes Region," "Aspects of Daily Life in Egypt," and "Documentary Films about Man." For more information call 922-9410, ext. 362.

### Continuing Programs

**Armchair Expeditions.** Adult groups (clubs, P.T.A., societies, etc.) can now attend special slide programs; tour selected exhibits. Arrangements can be made to dine in one of the Museum's private dining rooms. Winter programs include "Life in Ancient Egypt"; "The Weaver's Walk"; and "The American Plains Indian." For more information call (312) 922-0733.

**Winter Journey.** "American Indian Dwellings." Through February 28. This self-guided tour for families and children describes different types of American Indian homes found on the main floor of the Museum. Free Journey pamphlets are available at the North Information Booth, and at the South and West doors.

**Friend or Foe? The Natural History Game.** Field Museum's popular "Anthropology Game" has been expanded to include botany, geology, and zoology. The object here is to determine which one of a pair of apparently similar specimens is harmful and which is not. See if you can distinguish a vampire bat, a headhunter's axe, a poisonous mineral, or a deadly mushroom from its benign look-alike. Ground floor; no closing date.

**On Your Own at Field Museum.** Self-guided tour booklets, adult- and family-oriented, are available for 25¢ each at the entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

**Volunteer Opportunities.** Limited opportunities are available in botany, geology, and zoology. Weekend volunteers with an interest in natural history are needed to develop and present weekend programs. For more information call 922-9410, ext. 360.

**January and February Hours.** The Museum opens daily at 9 a.m. and closes at 4 p.m. Mondays through Thursdays. On weekends the Museum is open from 9 a.m. to 5 p.m. On Fridays the Museum remains open until 9 p.m. throughout the year.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at the reception desk, main floor.

Museum telephone: (312) 922-9410

February
1979

# FIELD MUSEUM OF NATURAL HISTORY BULLETIN

**Field Museum of Natural History Bulletin**

February, 1979
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*President and Director:* **E. Leland Webber**

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COVER

*Feather headdress made by the Jivaro tribe of Peru. A mosaic of feathers is mounted on barkcloth and ornamented with equally colorful buprestid and scarab beetles. This unusual piece, one of 260 to be on view in Hall 26 beginning February 15, was collected in 1891 for the World's Columbian Exposition. Length 64 cm, width 31 cm. Cat. no. 6052. Photo by Ron Testa. Cover story on p. 7.*

# FIELD BRIEFS

### Marshall, Turnbull, and Testa On South American Fossil Dig

Chubut Province, southern Argentina, is the site of a recent fossil dig by Field Museum paleontologists Larry G. Marshall, visiting assistant curator of geology, and William D. Turnbull, curator of fossil mammals. The object of their search is mammals of the Cretaceous period (135,000,000-65,000,000 years ago). Ron Testa, head of the Division of Photography, accompanied the paleontologists to document their work on film. Marshall's work was supported by a National Geographic Society grant.

The Museum's first acquaintance with the Chubut Province fossil beds was more than half a century ago, when Elmer S. Riggs, former curator of paleontology, made significant finds there.

### Botanists Join Staff

Two recent additions to the Department of Botany staff are Michael O. Dillon, visiting assistant curator, and Timothy C. Plowman, assistant curator. Dillon, a native of Kansas City, MO., received his B.A. and M.A. from the University of Northern Iowa and his Ph.D. from the University of Texas (Austin). A special interest of Dillon's is the Compositae (daisy family); his field work has included activity in Peru and Mexico.

Plowman, a native of Harrisburg, Pa., received his B.A. from Cornell University and his M.A. and Ph.D. from Harvard University. He then served as a lecturer at Harvard and was a postdoctoral research fellow at the Harvard Botanical Museum. Plowman has done special work on medicinal plants of the Upper Amazon Basin.

### Vandenbosch Named Women's Board Secretary

The new secretary of the Field Museum Women's Board is Susan E. Vandenbosch. She succeeds Alexandra Mente, who had held the position since March, 1976. Previously Miss Vandenbosch was with Marshall Field & Company, where she coordinated special merchandising events, benefit fashion shows, and other promotional activities. A native of Alma, Michigan, she holds a B.A. from Michigan State University.

### Anthropology Internship Program

Stop, look, and recognize the roadsign of the 1979 poster for the Anthropology Internship Program offered by the Center for Advanced Studies at Field Museum. The

program is supported by a grant from the National Endowment for the Arts, a federal agency.

The postmark deadlines for applications are April 3 for summer internships and July 3 for fall-winter internships, 1979. Applications may be obtained by writing: Anthropology, Center for Advanced Studies, Field Museum of Natural History, Roosevelt Road at Lakeshore Drive, Chicago, Ill. 60605.

### Scanning Electron Microscope Adult Education Course

The SEM course will again be offered this spring, beginning March 20. The course will meet once a week for five weeks, each session lasting from 7:00 to 9:00 p.m. Instructors are Alan Solem, curator of invertebrates, and Christine Niezgoda, herbarium assistant, Department of Botany. Course fee is $60.00. Enrollment is limited to 24 persons.

Information on dates and registration may be obtained by calling 922-9410, X-382, or by writing: Adult Courses: SEM; Dept. of Education, Field Museum of Natural History, Roosevelt Rd. at Lake Shore Drive, Chicago, Ill. 60605.

*"Earthquake Charlie," Field Museum's newest resident, is eased onto the Museum's freight elevator by Museum employees. The Alaskan polar bear had just arrived from Franklin Park, a Chicago suburb, where he had been the "guest" of sporting goods retailer James Bell, Sr.*

*A gift of Bell's to the Museum, Earthquake Chairlie has chosen as his permanent den The Place for Wonder, the ground-floor gallery where specimens may be touched, handled, or otherwise closely examined. The bear is 8'5" long and 6'8½" high (including platform); 38 inches is the girth of one front leg.*

*The date of Charlie's installation in The Place for Wonder will be announced in a future issue of the* Bulletin.

Fleur Hales

# METALS & MAN in the PREHISTORIC MIDWEST

BY THOMAS J. RILEY

Metals are one of the cornerstones of western technology, and they possess many properties which other materials such as stone, wood, and bone do not have. Yet, for more than two million years of man's existence on earth, metals and their uses were unknown. Technologies depended on the inherent limitations imposed by stone, wood, bone, clay, and plant materials for tools to provide subsistence and basic creature comforts. It might be argued that human ingenuity peaked in the complex primary tools that were made from combinations of these materials. The lethal efficiency of prehistoric eskimo harpoons, for instance, is a function of the complex use of bone for point and toggle, sinew for hafting and line, and wood for both the foreshaft and the mainshaft. For modern man, the uses to which Solutrean flint projectile tips were put is overshadowed by their delicate beauty suggesting an aesthetic in stone materials some 18,000 years ago.

But, no matter how complex or beautiful, the tools made from these materials show a relationship between man and material where man had to fit his ideas of utility within narrow limits imposed by the stone or bone that he was working with. The sculptor who works with marble must bow to the properties of stone as well as to limitations of talent and vision.

Metals, on the other hand, have a vast array of properties that broaden the range of man's technological and aesthetic capacity. Copper, the first metal used by man in both the Old and New World can be beaten into pins and beads, heated and annealed to make it soft and ductile, melted for casting, smelted from ores, and combined with other metals in alloys with different characteristics.

The Bronze Age was one of the turning points of Old World technology. It began sometime before 7300 B.C. with the discovery of some of the more limited uses to which copper could be put. This was the first of a long and arduous series of discoveries that led to casting and alloying. The development of metal technology in the Old World saw the invention of new and more durable tools, more efficient weaponry, and a whole array of household conveniences that had been impossible with a technology based on stone, bone, plant fiber, and sinew.

The study of the development of metal technology in the Old World has provided a number of important insights into the processes of cultural change that have led to our own industrial technology. The crucial question that has never been satisfactorily answered, however, is how the properties of copper first came to be recognized by ancient peoples. The occurrence and use of pure native copper in the ancient world is limited, and the artifacts that we have left for us to study are few and far between.

Oddly enough, while deposits of pure copper are rare in the Old World, the metal is abundant here in North America. Few people realize that as the Bronze Age was unfolding in Asia, the Near East, and Europe, Native Americans were discovering on their own the properties of metals such as copper, silver, and even iron. For several thousand years eastern North American Indians tottered on the brink of the "metal ages." This American Indian experience with metals is giving archaeologists some new and valuable insights into the transition from stone-based to metal-based technologies.

The first use of metals in North America occurred in a context quite different from that of the Old World. The discovery of copper and its uses in the Near East was by people already engaged in village agriculture. In North America, on the other hand, copper was first used by hunters and gatherers in the upper Midwest around 4200 B.C. Agriculture would not become an important

*Thomas J. Riley is assistant professor of anthropology at the University of Illinois.*

part of these Indian cultures until the introduction of maize into the area some 4,000 years later.

The North American copper-working tradition was heavily dependent on large, rich deposits of extremely pure native copper around the southern shores of Lake Superior and on Isle Royale (in Lake Superior) near its southwest margin. A second important source of copper for Native Americans in the midwest was in the tills of the great glacial advances of the Pleistocene. Large copper nuggets were pushed forward by the advancing ice sheets from the area of the present-day Great Lakes to places as far south as central Illinois and Indiana. Even today Illinois farmers sometimes find in their fields large rounded fragments of pure copper that were deposited there more than 18,000 years ago.

Between 4000 and 2000 B.C. Indians of Wisconsin were making a startling variety of tools from copper. By 2000 B.C. axes, spearheads, knives, awls, and even fishhooks were being produced by ancient craftsmen in such numbers that well over 20,000 of them have been recovered by collectors and archaeologists. At this time, too, copper and the implements made from it were being traded south and east from Lake Superior, apparently over well established trade routes following major river courses.

pits into copper-bearing deposits. Although most have been destroyed by modern mining, the remains of some of these pits can still be seen at Isle Royale and on Michigan's Keweenaw Peninsula.

Estimates of the copper removed from the Great Lakes area from the beginnings of the prehistoric copper industry at 4000 B.C. to European contact are hard to come by, but at least one source has placed the possible yield at between 200,000 and 1,500,000 tons of metal! More recently Claire Patterson, a California Institute of Technology geologist, has estimated that about 5,000 tons of copper was mined during the thousands of years of Indian copper exploitation in the Midwest. Even Patterson's low estimates represent a massive labor input over time with some ten million pounds of copper finding its way south to the Gulf of Mexico and east to Pennsylvania and New York in trade and gift exchanges.

For quite a long time archaeologists assumed that most of the copper tools made by prehistoric Indians were simply cold hammered from native copper nuggets, and that the technology that they represented was basically uninteresting. Unfortunately, few archaeologists have any training in metallurgy and cold hammering was thought to be the simplest technology that

*Copper bird effigy. Eye is of pearl. From Hopewell Site, Ross County, Ohio. Cat. no. 56356. Gift of W. K. Moorehead.*

The trade in copper decreased during the thousand years before Christ and then increased again at about 150 B.C. with the development of what archaeologists have called the Hopewell Interaction Sphere. Copper appears to have been considered an important metal by people who participated in this massive trade network that encompassed the eastern United States from upper New York state to Florida. It is found in association with burials in conical mounds and was apparently used both for decoration and for the production of ceremonial objects.

The exchange of copper from the Lake Superior region was so heavy that Native Americans had turned from collecting surface copper outcrops and nuggets to sinking deep mining

could produce the array of tools that they recovered from prehistoric Indian sites in the Midwest. They did not realize that cold hammering is often accompanied by annealing — heating the copper to a temperature below its melting point to soften it so that the metal can be more easily reduced.

At first glance, copper seems to be an easy metal to shape by cold hammering. Indeed, a number of simple tools such as awls can be produced by simply hammering a lump of copper into an elongated form with a point at one end. But with extensive cold hammering alone, copper becomes brittle as it is reduced. After awhile the hammer-wielder finds his hammer bouncing off the deformed nugget with no appreciable results in

*(Continued on p. 24)*

# Edward E. Ayer Film Lectures

## March and April

*Saturdays, 2:30 p.m.*
*James Simpson Theatre*

The ground-level west door entrance provides free admission to James Simpson Theatre. However, access to other museum areas requires the regular fee or membership identification. These illustrated lectures are approximately 90 minutes long, and are recommended for adults. Doors open at 1:45 p.m.

**March 3**
*Venezuela: Land of Natural Wonders*
by George Lange

Beginning in the modern capital city of Caracas and ending at Angel Falls, the world's highest waterfall, this film includes exotic wildlife, rugged scenery, and scenes of Venezuela's diverse peoples.

**March 10**
*Russia*
by Dick Reddy

A tour of Russia, taking you to some of her great cities and historical landmarks: Moscow, Leningrad, and Kiev; the Kremlin, the Winter Palace, and the Hermitage. The Bolshoi Ballet and Black Sea resorts are also on the itinerary.

**March 17**
*Sweden—A Midsummer's Dream*
by Ric Dougherty

See Sweden from the south at Malmo to the north at Kiruna. You will visit the famous glassmaking region around Orrefors and accompany the Lapps on a reindeer roundup. Folk arts and customs are also the subjects of Dougherty's camera.

**March 24**
*Germany—Once upon a Time*
by Kathy Dusek

Germany is rich in myth and legend. Think of all the folktales that originated there: Snow White, Hansel and Gretel, The Pied Piper, and many more. Travel to the land and the people that still exist in story-book Germany.

**March 31**
*Egypt—Gift of the Nile*
by Doug Jones

One of the world's most ancient cultures is also in the forefront of modern events. From King Tut to Sadat, this film traces Egypt's remarkable history.

**April 7**
*China after Mao*
by Jens Bjerre

This is a rare opportunity to travel through modern China. Every scene abounds in unexpected surprises. You will see how the world's most populous nation is striving to become one of the most advanced.

**April 14**
*The Marsh—A Quiet Mystery*
by Tom Sterling

In an effort to increase public awareness of the value of wetlands, Tom Sterling has explored, studied, and filmed the marsh and its life. Filmed most extensively in the Michigan marshlands, this work also incorporates the marshlands of Utah, Oregon, and Ontario.

**April 21**
*O Canada!*
by Ken Richter

"O Canada!" is a filmed exploration of two facets of Canada's identity: that 200 years ago Canada decided not to cut its ties to the Old World; since then it has made an effort to preserve the cultural heritages of many peoples who now live there.

**April 28**
*Discover Japan*
by Ted Bumiller

Japan, with its civilization so profoundly different from our own, both surprises and excites the traveler. Among the places you will visit are: Mount Fuji, Tokyo, Kyoto, Hiroshima, and Nagasaki.

# Feather Arts

BY PHYLLIS RABINEAU

*Photography by* Ron Testa

On February 15, Field Museum will open the doors of a new exhibition, *Feather Arts: Beauty, Wealth, and Spirit from Five Continents.** For four months, 260 beautiful objects from many cultures, all made from feathers, will be on public view in Hall 26; the exhibit will then travel to hosting museums throughout the United States for an additional 18 months. This is the first major travelling exhibit to be drawn almost entirely from Field Museum's own permanent collections. Most of the objects have never before been on display, but were selected from the extensive research collections housed in the Museum's storage area.

All colors of the rainbow, all sizes, shapes, textures, and moods will be found in the feather works drawn from cultures of all parts of the globe. In addition to explaining the techniques involved in creating the objects, the exhibit will explore several themes, each a universal aspect of feather arts: plumage as body ornamentation, feathers used for wealth and status, and the symbolism of feathers in religious beliefs. (See the December 1978 *Bulletin* for additional information on the exhibition content.)

As curator for this exhibit, it is an exciting time for me. A project I have worked on for over three years is about to be completed—something which has been a private research endeavor is at last to become quite public. Already, I have marvelled at the growing number of Museum specialists working on various aspects of this project: preparators putting together Plexiglas display mounts, the conservator cleaning and reconstructing long-unseen artifacts, the editor refining catalog copy, the ornithologists identifying specific feathers in each artifact, the photographer patiently adjusting the lighting for catalog photographs, the designer arranging a model of the exhibit hall. All of these people are using their special talents to create a marvelous experience for the Museum visitor. I have truly enjoyed the collaborative effort which is making my idea a reality. By working closely with this team, I have learned a great deal—from our discussions have resulted fresh ideas about the artifacts as well as new insights into the process of collaboration. In the long run, while I will be happy to see *Feather Arts* in its final form, my greatest reward will be the invaluable experience of having participated in this undertaking.

For most people working at the Museum—and undoubtedly for most of our visitors—feather arts are a revelation. They've never seen most of the objects, or at least never paid attention to them. Everyone knows what a Plains Indian eagle feather war bonnet looks like, but how many people know what kind of feather headdresses are worn in Brazil, the Philippines, or New Guinea? Even in the professional anthropological literature, feather arts are virtually ignored,

**Overleaf.** *P. 8: Topknot plumes of the crowned pigeon decorate a man's ornamental comb from Papua New Guinea (detail). Total length 41 cm. Cat. no. 276369. P. 9: Two different styles of men's headdresses from Brazil.* Above, *a simple string of brown, yellow, and red, made by the Kayapo; length 112 cm.* Below, *an intricately crafted and brilliantly colored feather "visor" made by the Urubu; diameter 32 cm. Cat. nos. 288190 (above), 168283 (below).*

*Members' preview Wednesday, February 14

*Phyllis Rabineau is custodian of the anthropology collections.*

*A pair of head ornaments from the Philippines shows cut and trimmed feathers. These buoyant plumes responded to every movement of the wearer's head. Height 49 cm (each). Cat. no. 109407/1,2.*

though they are made almost everywhere. Volumes are written about ceramics, woodcarving, textiles, and metallurgy, but these more delicate artifacts made from plumage are seldom mentioned.

I began thinking about feather headdresses in my graduate studies at Brown University, whose small anthropology museum has a remarkably well-documented collection from the Cashinahua, a native people of eastern Peru. There were almost 100 feather headdresses, and I studied the individual variations among them. I soon became fascinated with the symbolic meaning of these objects and began to research not only featherwork but the religious ceremonies in which it was employed. To my surprise, I found that anthropologists had given very little attention to this material, even though feather headdresses are the most striking form of visual art to be found in all of tropical South America.

When I came to Field Museum as custodian of anthropology collections in 1974, I had a fabulously rich resource at hand: one of the world's great anthropology collections. My job was to care for the storage collections, and to help visiting researchers use them—to be a "librarian" of artifacts rather than books. From the start, I spent a great deal of time in storage rooms, learning what riches could be found at Field Museum, so that I could help others locate collections they might need.

In this "library" I found myself constantly drawn to the artifacts made from feathers, objects recently added to my experience. Delicate feather inlay jewelry from China, eerie black feather costuming from Melanesia, buoyant dance ornaments from the Philippines—it was an incredible discovery! Once again, I set out to read what I

*A rare headdress from the Torres Straits (Papua New Guinea) was worn during special dances whose strenuous movements demonstrated the virility and stamina of the male performers to an admiring female audience. Length 50 cm, width 36 cm. Cat. no. 276369.* ►

could about these objects and their cultural context and, as before, I was surprised to find that there was precious little to go on. A few scholars had examined the techniques, the psychology, and the use of feather ornaments in scattered areas of the world, but it was largely unexplored terrain. One had to dig ever deeper for a few nuggets of fact or theory, and so it was only natural to try to relate information about feather arts from the Pacific, for instance, to additional data from South America. The similarities and the differences were always of interest to me.

The idea of putting all these beautiful objects together in an exhibit, comparing their uses and meanings, came about from the simple impulse of wanting to be able to walk into a room full of the things I had been looking at in widely-scattered corners of our storage areas. I began to talk about the idea at the Museum, and then I had a stroke of the most wonderful luck. A new collection of Brazilian featherwork was given to the Museum by Mr. and Mrs. Theodore W. Van Zelst of Glenview, Illinois; they also offered a grant to cover part of the expenses for an exhibition as well as for a catalog on feather arts!

And so the real work began: the final detective work with scholarly sources, looking for data on cultural contexts of the artifacts; the intensified search in storage collections. Finally, last spring, I began to work closely with the exhibit designer, Clifford Abrams. We made the final selection of artifacts to be displayed, defined the theme areas, and decided which artifacts would best typify those themes. I set to work writing labels and catalog text while he designed the installation. Gradually we picked up more and more coworkers to take care of the hundreds of details involved in a project of this kind.

There are still many problems to be solved, especially the thorny question of how to pack and ship these delicate and fragile objects. While certainly not as valuable as the golden treasures that have recently been displayed around the United States, these objects are important as beautiful art works, fragile survivors of craft traditions no longer practiced, and often embodying spiritual beliefs which we must respect. However, most of the work has been completed, and for me this particular project is almost ended. The designers and preparators will move on to the next exhibit—and I will return to the storerooms. For me, in a sense the work has only begun on feather arts. In the course of assembling this project, I have uncovered several provoking questions, some mysteries about the craft and context of featherworks. There is a lot more research waiting to be done, more feathers to be seen, and—it is hoped—some fieldwork to be done in a living craft tradition. I'm looking forward to the next step. □

*Gifts of feather capes were traditionally used to seal political agreements among Hawaiian chiefs. This use was later extended to European dignitaries, and this cape was presented to England's George IV by the Hawaiian King Kamehameha in 1821. Diameter 80 cm. Cat. no. 272588.*

# A Glimpse Of The Porcupine Mountains

*Text and photos by John and Janet Kolar*

*The Kolars' camera lens found these mushrooms (family Agaricaceae) nestling in a shaded wood.*

About 1,500,000,000 years ago a convulsion of volcanic activity devastated the southern edge of the Canadian Shield—a vast plain of Precambrian rock covering the northeastern fifth of our continent. Immense volumes of lava spread across the surface until the crust sagged beneath its weight, creating the trough of what is now western Lake Superior.

Simultaneously, the edges of this basin lifted above the surrounding surface, forming, on the north, Isle Royale, and south of the lake, a ridge running from the Keweenaw Peninsula to near the present Wisconsin-Michigan border. Then, sections of the southern edge of this ridge broke off and lumped back toward their original elevation, forming lines of alternate cliff and valley, parallel to the lake shore. Today, these ridges, polished by glaciers and eroded by rivers draining northwestward into Lake Superior, are known as the Porcupine Mountains, the name originally given them by the Indians.

Before the coming of white settlers, most of Michigan's Upper Peninsula was covered by a mixed conifer-northern hardwood forest. Then, around the mid-1800s, the hardwood component of this forest began disappearing into charcoal kilns. The charcoal, in turn, was used to fuel smelters that produced pig iron, which went to manufacturing centers of southern Lakes Michigan and Erie. Because of the distance to lumber markets, the pines (softwoods) were not cut in great quantities until near the end of the century, when the Soo Canal was opened. The products of the saw mills could then be shipped economically down the Great Lakes. As a result, accessible stands of pine were readily depleted. But within the mountain region, the irregular terrain and the turbulent rivers succeeded in preserving many virgin stands of pine and hemlock, together with their original associations of ferns and lichens. Today, even areas that were logged are now tending toward stable native climax forest, passing through a natural succession of plant communities. Only in continuously disturbed areas along roads and in campgrounds do the introduced Eurasian weeds occur in abundance.

Some 85 miles of trails are arrayed in a network across the Porcupine Mountains. A few cross the scrub oak cliffs above Lake Superior and eroded escarpments overlooking the interior river valleys; others descend to these valleys, following streams and rivers that acknowledge each geological stratum with a waterfall or rapids. Some trails come to abrupt ends at peaks or at overlooks; others meander along lake shores and swamps that are reminders of the last glacier. Several routes follow old logging and mining roads which were not prohibited until 1945. At that time, the state of Michigan designated 91 square miles a state wilderness area in a modest gesture of deference to a land that was ancient when our species was new. □

Overleaf. *Falls and rapids on Lower Presque Isle River.*

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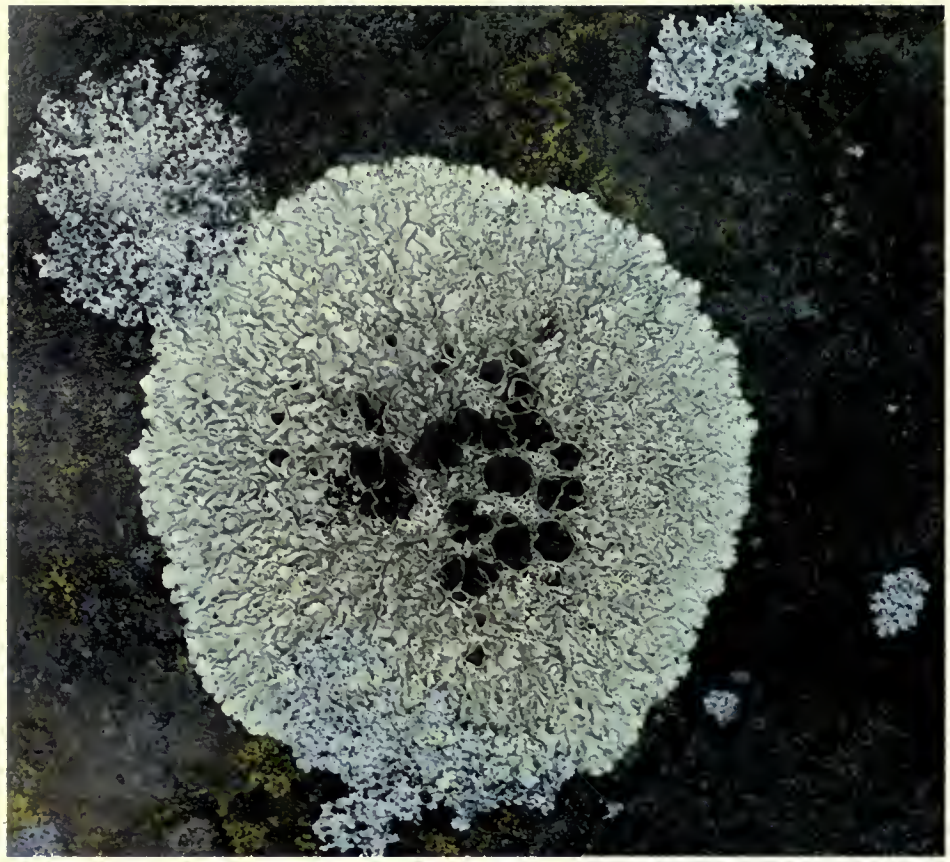
*The photographic art of John and Janet Kolar frequently appears in the* Bulletin. *John Kolar is a Field Museum volunteer.*

*Lake of the Clouds, east end. At upper right may be seen marshes of Inlet Creek. Hills at left are overgrown with virgin stands of white pine and hemlock.*

*Falls on the Union River*

*Mushroom, family Agaricaceae*



*Patches of lichen grow on exposed rock face of Canadian Shield.*

*Quiet section of the Carp River, west of Lake of the Clouds*

*Edge of Presque Isle River is lush with American arbor vitae and brilliant sugar maple. Clearly visible is graze line, or browse line, of resident deer.*

# The Solar Eclipse Of February 26

BY EDWARD OLSEN

In Mark Twain's novel, *A Connecticut Yankee in King Arthur's Court,* the hero at one point, finding himself in a tight spot, invokes the heavens to blot out the sun. When this happens, the populace, including the knights and ladies of the court, cry out in amazement and declare him a magician of the greatest kind — much to the consternation of his arch-rival, Merlin, the magician.

In a similar situation one of the heroes of H. Ridger Haggard's nineteenth-century thriller, *King Solomon's Mines,* pulls off the same stunt and saves the expedition from the hostile designs of a large tribe of Africans.

What these tricksters did, of course, was to wave their arms in the air and chant a "magic word" or two at the very moment a total solar eclipse was to begin. You have to agree it's pure magic for someone not only to remember, down to the minute, when a solar eclipse is going to take place, but to remember even the path of totality across the face of the earth. Anyone with that kind of memory deserves all good things that come to him.

Eclipses are indeed awe-inspiring sights. On February 26, we in North America will have a chance to see what will be the last total eclipse to be visible from this continent in this century. Unfortunately, the Chicago area will not be in a position to see a *total* eclipse; a partial one will be visible, however.

A total solar eclipse occurs when the moon passes directly between an observer on earth and the sun. The moon travels around the earth, and the pair — the moon and earth — travel around the sun. The moon, however, doesn't move around the earth in the same place as the earth goes around the sun. If it did, then every month, or twelve times a year, an eclipse would take place at lower latitudes on earth. Because of the tilt of the plane of movement of the moon around the earth, only an average of 2.37 total eclipses occur each year (that is, 237 eclipses in 100 years).

Even when a total eclipse is taking place, it cannot be seen everywhere on earth. It's obvious that those parts of the earth on the side opposite the sun — the night side — cannot see it at all. For those places on the day side, it depends on whether you are in direct line with the moon and sun. Predicting where and when total eclipses will take place was one of the first real successes of the modern mathematical sciences, although there is some hint that primitive builders of stone rings — like the famous Stonehenge in Wiltshire, England — may have had some notion of how to predict this phenomenon several thousand years ago.

For the eclipse on February 26, the path of totality will run from the northwestern United States (including parts of Oregon, Washington, Idaho, Montana, and North Dakota) across Canada, passing close to Winnipeg, then northeastward across Hudson Bay, Labrador, and en-

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*Viewing the solar eclipse of Oct. 19, 1865, in New York*

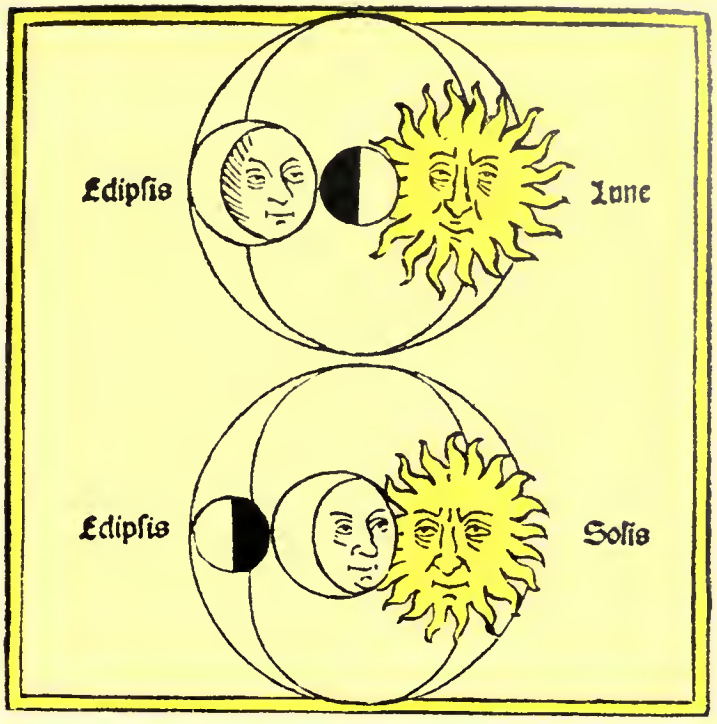
ding in Greenland. In Chicago we are situated at an angle so that we'll see the moon blot out only about half the sun's face.

When viewing an eclipse, total or partial, there is a real danger of eye damage. Viewing the sun directly by eye can cause searing of the retina, which could lead to impairment of vision and, in extreme cases, blindness. Using ordinary sunglasses is *not* protection enough!

The safest way to view the eclipse is this: Take a big cardboard box, large enough to get your head and shoulders inside of it. With a large nail, punch a small hole through one side. Then stand inside the box, facing away from the direction of the sun, and move the box around so the image of the sun is projected through the hole onto the back wall of the inside of the box. When the moon's shape passes over part of the sun's face you'll see the image projected on the back wall of the box. Since you're only looking at a projected image of the sun you can't hurt your eyes. What you are doing is actually standing inside a simple lens-less camera — a so-called pinhole camera.

Because the sun is the central luminary body of our solar system it is of great scientific interest to us. Also, since it is a star, it is the only star we can study at close hand. Is it getting more active? Is it getting less active? How does its radiation affect radio communications here on earth, and the atmosphere of the earth? These are questions that can be studied during solar eclipses. Although it is possible to make scientific measurements of the sun on any clear day, certain kinds of measurements and observations can only be made during a total eclipse. This is why many astronomers set up temporary field stations along the path of totality prior to the eclipse. Most of their observations are made photographically.

By pure coincidence, the sizes and distances of the moon and sun viewed from the earth are such that they each subtend about a half degree of arc. This means that under the conditions of a total eclipse, the moon can almost exactly cover the sun. Were the moon much larger, or much closer to earth, then the sun would appear somewhat smaller than the moon and disappear completely behind it. As it is, under the best conditions, the thin outer fringe of the sun's atmosphere is just visible with the bright center blotted out. This permits photographic measurements to be made on the solar atmosphere without being ruined by the glaring light from the face of the sun.*



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*1462 diagram of how an eclipse occurs*

When the bright center of the sun is blotted out we can see long, streaming flares of hot gases shoot out thousands of miles into space from the sun's surface. From study of these flares we can determine some of the features of the magnetic and electrical fields that are generated around the sun. By means of the spectrograph we can also determine what chemical elements occur in various levels in the sun's atmosphere.

One of the most dramatic uses of solar observations during a total eclipse first took place in 1919. Einstein's theory of relativity had already predicted that a ray of light can be bent from a straight path when it passes close to a very massive body. By measuring the apparent position of a star whose light rays pass close to the sun on their way to earth, it was indeed found that the star's light was slightly bent by the right amount. Since 1919 this bending of light rays has been measured many times during solar eclipses and verified with greater accuracy each time.

Some measurements, however, made many times during total solar eclipses, have created a scientific puzzle that has still not been completely solved: The sun's surface has a temperature of about 6,000°C (about 11,000°F). Surrounding the surface is a region of gas called the chromosphere, which is hotter than the surface — around 25,000°C (about 45,000°F). Above this is the sun's upper atmosphere, the *corona*. Its temperature is a scorching 1 million degrees C (1.8 million degrees F). How is it that the temperature way above the sun's surface is about 140 times hotter than the surface?

This question, and others, will be studied during the coming eclipse. What a disappointment it will be if February 26 is a cloudy day! □

*Edward Olsen is curator of mineralogy.*

*Because the paths of the earth around the sun, and the moon around the earth, are not perfect circles, the earth-moon and earth-sun distances change slightly at different times of the year. This means that for some total eclipses the outer fringe and a thin edge of the sun's disc show around the outside of the moon. This is called an annular total eclipse.*

# OUR ENVIRONMENT

### Crustacean's Last Toehold: Rusty Drainpipe

A 90-foot piece of iron drain pipe leading to an abandoned bath house in New Mexico is the only home for 2,500 remaining Socorro isopods.

The U.S. Fish and Wildlife Service has proposed that this relative of the common sowbug be listed as an endangered species because of the link it may provide in the ecological and evolutionary web.

This half-inch freshwater crustacean, which eats the algae lining the drain pipe, is one of only two freshwater species in a family that is otherwise entirely ocean-dwelling.

Biologists think it may provide the key to understanding how this and other land-locked relic animals evolved from ancient marine isopods that lived in the oceans once covering much of the western U.S.

The Socorro isopod adapted to the warm, fresh water of a spring, where it lived for millions of years until the spring was capped in 1949. After that, the only place left to this small creature was the section of drain pipe.

This, the isopod's last toe hold, now is threatened by periodic drought and flushing of the pipes.

### Dogs for Combating Coyotes

Komondors, which are shaggy, heavy dogs first bred in Hungary to keep wolves from preying on sheep, are the subjects of a $33,000 U.S. Department of Agriculture experiment to see if they can do the same for western sheep ranchers who claim coyotes are killing their sheep. Weighing as much as 120 pounds and costing up to $500, the dogs may be the sought-after alternative to shooting, trapping, and poisoning the clever coyotes. Komondors have already been found to frighten caged coyotes simply by walking past them. The tests, to examine ease of handling the dogs and their effectiveness in repelling coyotes, will be conducted at Colorado State University in Fort Collins and the U.S. Sheep Experiment Station in Dubois, ID.

### Tipsy Birds

Around Perryville, R.I., the small, red berries of the Russian olive bush, overripe and slightly fermented, have been intoxicating flocks of birds that snack on them. Local farmers and motorists watch in amazement as birds haphazardly swoop down and over the highway, many missing their mark and slamming into trucks and cars. Such dive-bombing antics have strewn dead birds along the roadside, yet police are loath to charge the birds with f.w.i.—"flying while intoxicated."

### Feds Act to Reduce Bird-Aircraft Collisions

The Federal Aviation Administration and the Interior Department's U.S. Fish and Wildlife Service have stepped up measures to prevent collisions between planes and birds and to further advance airline passenger safety.

Bird strikes, numbering about 1,200 annually, cost an estimated $20 million each year in damage to military and civilian aircraft. A 4-pound bird striking a plane moving at 500 miles per hour impacts with a force of 80,000 pounds and has been known to shatter a windscreen and badly dent the opposite cabin bulkhead. More often, however, birds are sucked into the jet engines, which can be instantly knocked out.

Bird strikes, or collisions, have also been blamed for the loss of 140 human lives in this country since such record-keeping was started in the 1940s. The most serious accident occurred in 1960 in Boston, where 62 persons died after their airliner flew into a flock of starlings.

Most bird strikes occur during take-off and landings, but the birds are also a threat in the air during the spring and fall migration season when millions of ducks, geese, swans, and other birds migrate in dense formations at altitudes as high as 20,000 feet. Bird populations at airports also swell significantly at these times.

Situated in many cases near water, mud flats, or marshy areas and quite often close to solid waste disposal sites, airports also attract birds because of architectural features that invite roosting, and decorative pools that birds use for bathing and drinking. Other attractions include standing water on runways or adjacent areas, tall grasses, fruit trees, and other vegetation, and the related insect and rodent food supply.

Simple techniques include draining pools, filling the low spots on runways, removing certain trees and shrubbery, and cutting grasses to certain heights. Other techniques include relocation of existing garbage dumps that may be in air traffic corridors, and operating regular motor patrols of the runways to disperse birds. Dispersal methods such as distress calls and explosive noise devices are also used to reduce the risk of bird strikes. All of these deterrents are aimed at denying food, water, and roosting areas to the birds in an effort to make them seek other, safer habitats.

### Mastodons as Fox Bait

A Siberian native has probably found the ultimate in well-aged trapping bait. The trapper had exceptionally good luck catching foxes on his trapline using meat he had found frozen out on the tundra. Paleontologists then discovered that the bait was from the leg of a 13,000-year-old mastodon.

The paleontologists also found traces of an ancient settlement near the mastodon site. They estimated the age of the campsite to be about 13,000 years.

### Ultrasonic Pest Repellent

Bob Brown, a California guitar player crippled by polio, has invented a device capable of making sound so shrill that it drives rodents wild, kills cockroaches, and sends fleas flying. The frequency of the sound is over a million cycles a second; the human ear can hear up to about 20,000 cycles.

In a recent 12-month period, Brown sold 18,000 of his so-called "rat-repellent boxes." The government of Venezuela ordered 300 to kill cockroaches in food stores; 1,000 were bought by Spain to eliminate rodents from granaries.

# Treasures of Russia and the Ukraine

## 20-day tour for Field Museum Members and their families

*THE SPLENDORS OF OLD RUSSIA, the excitement of the New are in store for Field Museum Members and their families who join the tour "Treasures of Russia and the Ukraine," leaving Chicago's O'Hare Airport June 19 and returning July 8.*

*Highlights of this exclusive tour will include visits to the cities of Moscow, Vladimir, Kiev, Leningrad, Petrovorets, Novgorod, and Petrozavodsk. The group, limited to 35 persons, will be led from Chicago by two Russian-speaking escorts, with additional guides while in the Soviet Union provided by* Intourist *(the Soviet Travel Bureau).*

*The tour cost—$2,970 (which includes a $500.00 donation to Field Museum)—is based upon double occupancy and includes round trip air fare from Chicago to Moscow, with intra-Russian air transportation where required. The transatlantic airline is Swissair.*

*Deluxe hotel accommodations will be used throughout or, where necessary, the best hotels available. The package includes all meals, including inflight meals; all sightseeing via deluxe motor coach; all admissions to special events and sites, where required; all baggage handling throughout, plus all necessary transfers; all applicable taxes and tips; all applicable visa fees. Advance deposit required: $250.00 per person.*

*For full itinerary, additional details, and registration information, please write or call Michael J. Flynn, Field Museum Tours, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.*

*Red Square, showing Lenin's Tomb, Moscow*

*Copper ornaments and pendants from Hopewell Site, Ross County, Ohio. On view in Hall 4. The headdress is of two parts: a thick, solid headplate and wooden antlers covered with thin sheet copper. (Cat. no. 56080). The ear ornaments (56201-2) and pendants (56114, 56128) are of copper. (The necklace is of freshwater pearls.) Gifts of W. K. Moorehead.*

*Continued from p. 5*

forming his tool. The metal, made brittle by cold hammering, often cracks and fractures.

It took trained metallurgists interested in ancient technologies to begin to unravel the mysteries of native copper technologies in native North America. They did this by applying the techniques of metallography to the study of Indian copper working. Their research has shown that either hot working or successive anneals were important to the manufacture of native copper artifacts in the prehistoric Midwest. Unfortunately, a number of archaeologists have not understood the importance of their work, and at least two recently published textbooks in American prehistory still cling to the notion that Native American copper from the Midwest was produced by simple cold hammering.

Metallography, simply put, is the study of the internal structure of metals by various techniques including the use of powerful optical and electron microscopes. Metallographers most commonly study the structures of metals to discover the physical properties that determine the utility of metals for commercial and industrial purposes. A few metallographers, however, have turned their attention to the study of ancient metal artifacts to determine techniques of manufacture as well as the possible uses to which these tools were put. Native copper, like all metals, is crystalline in structure. When it is subjected to different treatments in manufacturing, the structure of the metal realigns itself in certain predictable ways. Extensive cold working, for instance, will deform the regular crystal alignments that metallographers call grains by compressing them or breaking them up. Reducing copper by cold hammering produces lines of flow perpendicular to the force of the hammer blows. Metallographers can see these patterns of deformation through an optical reflecting microscope when the metal is polished and etched with different corrosive solutions.

Annealing is accomplished by heating copper to a temperature above 200° to 225°C but well below its melting point of 1,083°C. This allows the metal to recrystallize, often with the formation of distinctive paired linear structures called "twins" within the grains.

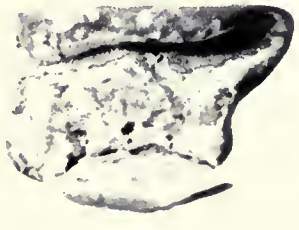
Melting and alloying produce other, more complex structures within the metal. These microscopic structures permit the metallographer to reconstruct the techniques of manufacture of metal artifacts. In some instances they can determine the temperature at which the artifacts were worked and whether or not they were heated and worked in an oxidizing or reducing atmosphere.

In the spring of 1978, with the aid of Professor Heather Lechtman of the M.I.T. Center for the Study of Materials in Archaeology and Ethnology, I prepared a number of metallographic samples from copper artifacts found at several Hopewell Indian sites in Illinois. The samples were

*Stylized serpent made of copper, restored. From Hopewell Site, Ross County, Ohio. Cat. nos. 56701 (left), 56206. Gift of W. K. Moorehead.*

carefully cut from the artifacts with a jeweller's saw, mounted in a resinous medium, then ground and carefully polished so that surface abrasions were smaller than the wavelength of light. After this they were treated with solutions that would differentially etch the grain boundaries of the copper and accentuate the different planes of crystal alignments.

One of the samples from a Hopewell burial mound group near Utica, Illinois, is shown below: a small piece of native copper that has been partially rolled by cold hammering after an apparent anneal in a reducing atmosphere, probably under the ashes of a wood fire. When the sample was subjected to analysis under the microscope, the different techniques of manufacture become clear. At a magnification of ×50, the rolled end shows signs of the deformation of the metal perpendicular to the lines of force expected of cold hammering. On the thick end of the sample the grains are only partially deformed, and a number of partially bent "twins" suggest that the artifact was annealed before the final hammering process was begun. This part of the metal had not been reduced as much as the rolled end, and it is likely that the hammering had occurred after the metal had been allowed to cool. It also appears that the metal was hammered on the end that was rolled before the turning process began.



The tools of the metallographer, in this particular instance, permit the archaeologist to reconstruct the craft techniques of a Hopewellian craftsman who lived some 2,000 years ago in central Illinois.

An interesting feature of prehistoric midwestern copper working for the archaeologist is that it seems to occur in association with an innovation in stone tool technologies in the Midwest. Flints and cherts were one of the major materials from which prehistoric primary tools were made in North America. In Prehistoric North America some 10,000 to 3,000 years ago, Indian stone tool craftsmen began to treat flint with fire, "annealing" it before flaking stone tools from it. It is quite possible that the extensive copper working that is found in the Midwest from Archaic through late prehistoric times was simply an extension of the heat treatment of flint. Copper then, would have been considered just another stone which, when heated, showed properties different from those of flint in that it became soft and malleable rather than brittle and subject to fracture. It is possible that in the central part of what is now eastern United States the development of an extensive copper-working tradition depended on the innovation of annealing flint and other stone materials, and that a copper industry of any magnitude and duration would have been impossible without this innovation.

We know that one of the early stages of copper manufacturing in the Old World, too, depended on annealing the metal to make it workable. Is it possible that the copper industry there began with the extension of heat treatment techniques from flint and chert to the new material, native copper? At present little work has been done on the occurrence of heat treatment of flint in the Old World, but I would expect that this particular innovation in stone-working precedes the extensive use of copper for tools and artifacts wherever native copper appears in western and eastern Asia.

But copper was not the only metal used by prehistoric Americans. Small amounts of silver have been found in Hopewell sites in many of the Great Lakes states as well as in sites in Ontario. The silver has been beaten into thin sheets and used to cover reed whistles shaped like classical panpipes. Silver was also beaten onto a copper base to form large round earplugs shaped very much like large spools. Beads and head ornaments of silver have been found at a number of sites in western Wisconsin and Illinois.

Meteoric iron, too, has been found at sites both in Ohio and Illinois. A set of meteoric iron beads was recovered from a Hopewell mound near Havana, Illinois, by researchers from the Illinois State Museum in 1945. When subjected to metallographic analysis, it was discovered that the small beads had been cold hammered around a

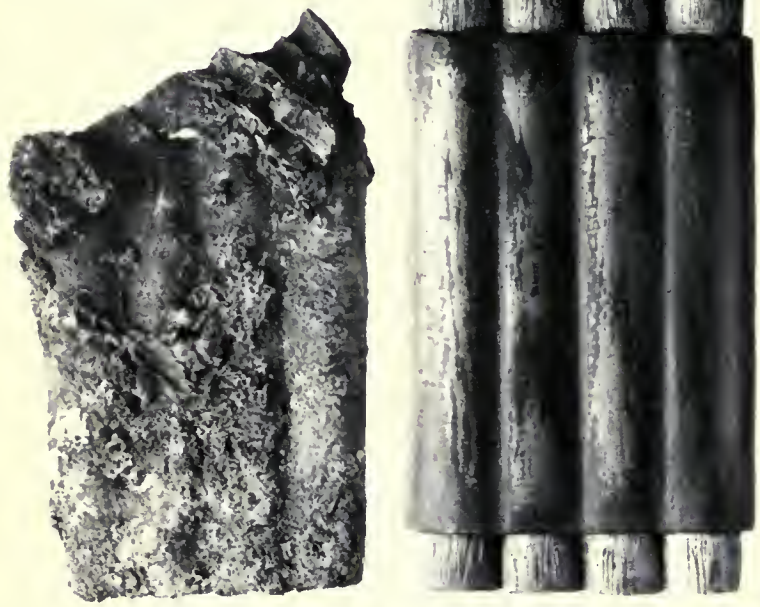
*Copper effigy of fish, from Hopewell Site, Ross County, Ohio. Cat. no. 56176. Gift of W. K. Moorehead.*

small cylindrical object to create center holes of the beads, then subjected to a light annealing procedure. The manner of production parallels the manufacturer of copper objects.

Prehistoric American craftsmen in the Midwest obviously recognized the importance of a number of native metals. Why didn't they develop that tradition into a regime of smelting, casting, and alloying that would have led to the beginnings of a bronze age in eastern North America? We shall probably never know the answer completely. It is probable that the abundance of native copper around the Lake Superior region made it unnecessary to develop procedures for smelting metal from copper oxide deposits, and thus the first major advance towards true metallurgy was not necessary in this part of the New World.

In the Near East, on the other hand, the scarcity of native metals made it necessary to melt deposits of copper oxide ores to maintain the nascent copper industry. From that start the development of more difficult techniques for smelting copper from sulfide ores followed rather quickly.

It is likely, then, that the eastern North American metal industry in prehistoric times suffered from an abundance rather than from a scarcity of relatively pure metals. Nevertheless, the achievements of prehistoric American craftsmen in extending the techniques of stone technology to copper, silver, and other native metals cannot be overlooked. It is an area where the metallurgists of our day using the sophisticated techniques of their trade can answer questions that the archaeologist left to his own devices cannot even begin to fathom.



Above: *Pan pipe of bone, with copper sheathing, original (left) and restoration. Cat. no. 56708. Gift of W. K. Moorehead.*

*Early engraving (1565) of Florida Indian chieftains adorned with copper pendants.*

# February & March at Field Museum

*(February 15 through March 15)*

### New Exhibits

**Feather Arts:** Beauty, Wealth, and Spirit from Five Continents. Opens Feb. 15. Conceived and created by Field Museum's own staff, this exhibit features exotic feather objects from around the world. Assembled almost entirely from in-house collections, "Feather Arts" will travel to other museums nationwide after its four-month stay at Field Museum. The 260 artifacts, drawn from 1,000 years of history, include such rarities as an Hawaiian king's feather mantle given to George IV of England in 1821, and the feather shoes of an Australian sorcerer. This fascinating exhibit examines the symbolic and religious meaning of feathers over the centuries and illustrates the importance of featherwork as a universal art form. Hall 26. Through June 15. (Members' preview February 14, 1 to 7 p.m.)

**A Stamp Sampler: Postage from Natural History.** Opened Dec. 8. This exhibit unites 63 natural history specimens with samples of philatelic art. Planned on a rotating basis to cover the four disciplines of natural history, the first 8 months of the exhibit are devoted to zoological specimens and their representations on stamps from all over the world. "A Stamp Sampler" was conceived by Field Museum volunteer Col. M. E. Rada, exhibit guest curator. The exhibition was designed by Peter Ho.

### Continuing Exhibits

**Primitive Art.** Art objects from Africa, the Americas, and Oceania are presented for comparison of the primitive societies. The relationship of primitive art to modern art are also considered. Hall 2.

**Gems.** This anthropological/geological exhibit contains Field Museum's fine collection of primitive jewelry from India, Algeria, South America, Italy, Egypt, and the Philippines. Second floor, south.

**The Place for Wonder.** This gallery provides a place to handle, sort, and compare artifacts and specimens. Weekdays, 1 p.m. to 3 p.m.; weekends, 10 a.m. to noon and 1 p.. to 3 p.m. Ground floor, near central elevator.

**Field Museum Gamelan.** Field Museum's 19th-century Javanese gamelan, an ensemble of 24 fine bronze and wood musical instruments, has been completely restored for exhibition. Hall K, ground floor.

### New Programs

**"Feather Arts: Beauty, Wealth, and Spirit."** An illustrated lecture by Phyllis Rabineau, curator-in-charge of the new "Feather Arts" exhibit. Feb. 28, 8 p.m. James Simpson Theatre. A lecture on diverse featherworking techniques; the use of feathers as ornamentation; and the cultural, religious, and symbolic significance of feather arts over the past 1,000 years. Members, $1.50; nonmembers, $3.00.

**The Edward E. Ayer Film Lectures** are scheduled every Saturday afternoon in March and April at 2:30 p.m. James Simpson Theatre. Reserved seating is available for members and their families. Doors open at 1:45 p.m. For complete March-April schedule, see page 6. March 3: "Venezuela—Land of Natural Wonders," by George Lange; March 10: "Russia," by Dick Reddy.

### Continuing Programs

**Armchair Expeditions.** Adult groups (clubs, P.T.A., societies, etc.) can now attend special slide programs; tour selected exhibits. Arrangements can be made to dine in one of the Museum's private dining rooms. Winter programs include "Life in Ancient Egypt"; "The Weaver's Walk"; and "The American Plains Indian." For more information call (312) 922-0733.

**Winter Journey.** "American Indian Dwellings." Through February 28. This self-guided tour for families and children desribes different types of American Indian homes found on the main floor of the Museum. Free *Journey* pamphlets are available at the North Information Booth, and at the South and West doors.

**Friend or Foe?** The Natural History (Botany, Geology, Anthropology, and Zoology) Game. Field Museum's popular Anthropology Game has been expanded to include the Museum's three other scientific divisions. The object is to determine which of a pair of similar-looking specimens is harmful and which is not. For instance, which South American tree frog is the source of poison for Indian darts? Or which shell animal contains a poison four times more deadly than cyanide? Ground floor.

**On Your Own at Field Museum.** Self-guided tour booklets, adult- and family-oriented, are available for 25¢ each at the entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

**Volunteer Opportunities.** Limited opportunities are available in botany, geology, and zoology. Weekend volunteers with an interest in natural history are needed to develop and present weekend programs. For more information call 922-9410, ext. 360.

**February and March Hours.** During February the Museum is open 9 a.m. to 4 p.m. Mondays through Thursdays. March Mon.-Thurs. hours are 9 a.m. to 5 p.m. February and March Saturday and Sunday hours are 9 a.m. to 5 p.m. On Fridays the Museum is open from 9 a.m. to 9 p.m. throughout the year.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Closed Feb. 19 (Presidents' Day). Obtain pass at the reception desk, main floor.

**Museum telephone:** (312) 922-9410.

March
1979

# FIELD MUSEUM OF NATURAL HISTORY BULLETIN

Field Museum
of Natural History
Bulletin

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*Camera portrait of a man of Inner Mongolia, by Stanton R. Cook (below), chairman and publisher of the* Chicago Tribune *and a member of the Field Museum Board of Trustees. Cook visited China in September, 1977, with a group of Associated Press directors. Photo essay on page 12. Photos courtesy* Chicago Tribune.

*Stanton R. Cook*

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# FIELD BRIEFS

### NSF Grant for Summer Anthropology Course

High school students must complete application forms by April 6 for this year's college-level, tuition-free anthropology course (June 25 through August 3, 1979) at Field Museum of Natural History. A $25 field trip fee is required for bus charters. The program is open to 27 high-ability high school students (priority given to juniors) who have the academic ability and interest in an intensive six weeks of anthropology.

Students are selected on the basis of academic achievement, teachers' recommendation, and personal interviews. Application forms are available from high school officials or may be obtained from Miss Harriet Smith, director of the N.S.F. Summer Anthropology Program, Department of Education, Field Museum of Natural History (922-9410, X-361).

Now in its fourteenth year, this program has been the only National Science Foundation-funded program in the U.S. that introduces all fields of anthropology for the career choice of high school students.

Monday-through-Friday sessions (9:15-3:00) involve students in concepts of man's relationship to his environment and his fellow man, with varied activities that include individual research projects, workshops, the study of museum specimens, and lectures by visiting professors and museum staff anthropologists. Representative of program and faculty are *Today's Careers in Anthropology*, by Phillip H. Lewis, chairman, Department of Anthropology, Field Museum; *Fossil Man*, by Ronald Singer, physical anthropologist, University of Chicago; *Midwestern Archaeology*, by Stuart Struever, archeologist, Northwestern University; *Environmental Life of American Indians*, by Merwyn Garbarino, ethnologist, University of Illinois at Circle Campus; *Africa—Tradition and Change*, by Peter Knauss, political scientist, University of Illinois at Circle Campus; *China, Longest Continuum*, by Kenneth Starr, director, Milwaukee Public Museum; *With the Gypsies in Pakhistan*, by Joseph Berland, cultural anthropologist, Northwestern University; *Chicago's Ethnic History*, by William Adelman, labor relations program, University of Illinois at Circle Campus; and *Behind-the-Scenes Demonstration of Anthropology Exhibits in Production at Field Museum*, by James A. VanStone, curator, Department of Anthropology, Field Museum.

A week of archeological field work at a local site provides application of the previous weeks of study. The excavation is under the direction of David Keene, S.J., historical archeologist, University of Wisconsin-Madison, with the cooperation of Edward Lace, naturalist-historian, Cook County Forest Preserves. Past participants have discovered abundant prehistoric and historic artifacts at this purported site of an 1828-32 fur-trading post.

### Christopher Legge 1905-1979

Christopher Legge, custodian of Field Museum's anthropology collection from 1962 to 1974, died on January 24, 1979. He will be long remembered for his dedication to the Museum and for his scrupulous devotion to the collection.

*Christopher Legge*

Chris Legge was an extraordinary man. His coming to Field Museum after a career in the British Foreign Service was in itself remarkable—as well as a stroke of very good luck for the Museum. But the event was hardly fortuitous. Chris's grandfather, James Legge (1815-97), was an orientalist, famed for his translations of Chinese classics, and Chris seemingly inherited his grandfather's own love and fascination for the Orient.

Born in Chelsea, England, in 1905, he graduated in 1928 from King's College, Cambridge, where he was an honors student and an outstanding athlete. Following graduation, Chris took a post with the Nigerian government, remaining in Africa for six years. He then—characteristically—did the unexpected, by going to Denmark for a year to study physical education. For the next two years he was a grammar school instructor in Australia. In 1938 he joined the British Foreign Service and was assigned to the Fiji Islands as district commissioner. He remained there until 1961, then retired.

When Chris applied for a position at Field Museum, he noted on his application form a special interest in "Oceanic archaeology and ethnology," never dreaming that in a few short months his responsibility would be one of the finest collections of such material in the world. So, at age 57, he embarked on an exciting new career—perhaps the one for which he was best suited.

The union of Chris Legge with the Field Museum was a perfect match. The collection of half a million artifacts required the attention of someone who was entirely devoted; and that devotion was embodied in Chris Legge. Colleagues in the Department of Anthropology would remark, half seriously, that Chris knew every single piece in the vast collection. But if he was respected for his dedication and knowledgeability, he was equally loved for his manner. His pleasant charm, his gentle ways, and his desire to accommodate endeared him to everyone.

After his retirement in 1974, Chris continued to frequent his beloved Museum as he pursued the various projects that appealed to his far-ranging intellect. Just before his death he completed a short biography of Richard Parkinson, an early explorer of the southwest Pacific.

To have known and worked with Chris Legge was a rare privilege. Field Museum was immeasurably enriched by his presence.—*Ed.*

### Anthropology Department Receives National Science Foundation Award

The National Science Foundation in Washington D.C. has awarded the Department of Anthropology a grant of $38,579 for the first of two years in support of systematic collections in anthropology (Phillip H. Lewis, principal investigator). This grant is for preventive and technical conservation of the Museum's outstanding textile holdings, numbering over 12,000 specimens from around the world, which have been described by one leading authority recently as "an incredibly rich resource."

Impetus behind Lewis's successful proposal to the NSF came from three directions. First, the Department of Anthropology has declared development of its conservation

division to be its first priority, now that the vast new four-floor Central Anthropology Storage Area (CASA) has been built within the Museum as a result of our recently completed Capital Campaign.

Second, new plans for textile care and storage were initiated by Joan B. Andrews of the University of Wisconsin (Milwaukee) in 1977. She was then one of the first "Interns in Anthropology" at Field Museum sponsored by a grant to the department and the Museum's Center for Advanced Studies from the National Endowment for the Arts in Washington D.C. Andrews drew up many of the guidelines and proposals which later formed the basis for the successful proposal to the NSF.

Third, and perhaps most important, during 1978 Jeannette Leeper, now registrar for the Laguna Beach Museum of Art, demonstrated conclusively that the economical procedures outlined by Andrews could be implemented effectively at the Museum to improve care and storage of the beautiful collections of *tapa* or "bark cloth" from the tropical regions of the world. At the same time, Museum Volunteers Sylvia Schuppert, LeMoyne Mueller, Karen McNeil and Judith Spicehandler carried out similar improvements for storage of African and North American textiles and comparable materials.

In the photograph at left, Jeannette Leeper is seen in front of the new tapa storage facility she installed at the Museum with the aid of Museum Volunteer Lorraine Peterson. She is shown being presented last year with an honorary *tapa* specimen (from the Museum's Shop) by John Terrell, associate curator of Oceanic archaeology and ethnology, prior to her departure for California.

Through this grant from the NSF, the work of Joan Andrews and Jeannette Leeper is being extended to all of the Museum's textile collections by conservation assistants Anna Campoli and Jan Di Girolamo, under the supervision of Christine Danziger, conservator, and Phyllis Rabineau, custodian of collections. Volunteers Sylvia Schuppert and LeMoyne Mueller have also expanded their own work on preserving our large and impressive textile collections, which are of both great aesthetic and scientific value.

*John Terrell, associate curator of Oceanic archaeology and ethnology, presents Jeannette Leeper with honorary* tapa *specimen.*

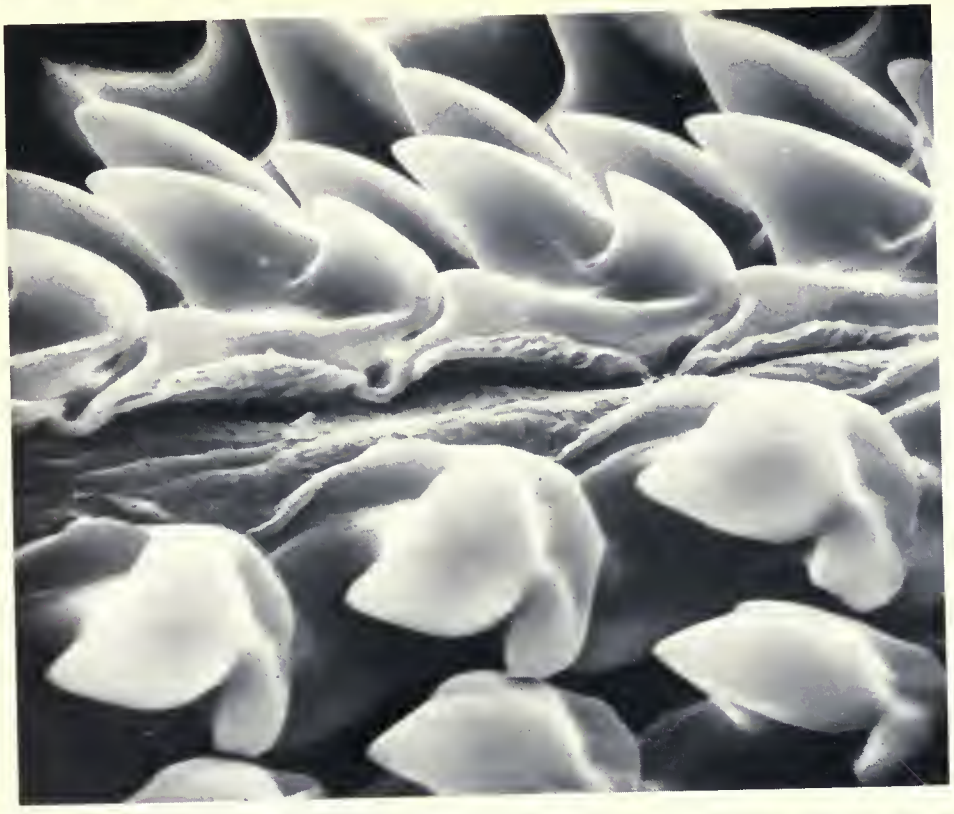
### Adult Education Course: Operation and Use of the Scanning Electron Microscope

The scanning electron microscope has revolutionized the study and photography of small objects by research scientists. With 500 times the depth of field obtained by optical lenses and the ability to magnify between 20 and 100,000 times life size, it is an important and versatile instrument. Preparation of specimens for study, basic machine operation, and adjustments for viewing difficult specimens are featured in the first two sessions of this course. In the last three sessions, material brought in by some of the participants is viewed and photographed. All pictures become the property of the participants.

The course is taught by Alan Solem, curator of invertebrates; and by Christine Niezgoda, assistant, Department of Botany. It meets once each week for five weeks, beginning March 20 or 21. Sessions last from 7:00 to 9:00 p.m. The class is divided into four sections of six participants each. Course fee: $60.00. For additional information call Lynne Houck, 922-9410, X-362.

### Gamelan Master Classes

Two courses on Indonesia's remarkable orchestral ensemble, the gamelan, are offered in March. An introductory course includes basic techniques of performance, musical structure, and the cultural background of gamelan music in social and ceremonial uses. An intermediate course features Java-



nese singing and simple gender accompaniment on the gamelan. Prerequisite for the intermediate course is an introductory gamelan course at Field Museum or at a university school of music. When the courses are completed, participants will give a public concert held at Field Museum. The instructor for both courses is Sue Carter-De Vale, gamelan program director, Field Museum.

The introductory course meets Tuesday evenings from 7:00 to 9:00 p.m. for 10 weeks beginning March 13. The intermediate course meets Wednesday evenings from 7:00 to 9:00 p.m. for 8 weeks beginning March 28. Participants should be physically able to remain seated on the floor for several hours—the position for playing many of the instruments. For information and registration, please call the Department of Education, 922-9410 X-362.

*The scanning electron microscope, which can magnify 20 to 100,000 times life size, has opened new worlds for the scientific investigator.*

*A gamelan master class practice session*

# War and Peace —Pigeon Style

BY PATRICIA WILLIAMS

Robins signal spring. Eagles symbolize power and authority; peacocks, pride. But the pigeon? Pigeons definitely have trouble with their image — especially among city dwellers, who are most likely to associate the bird with whitish droppings staining buildings, park benches, and, more personally, clothing. However, this is a rather one-sided view. In matters of love and faith, war and peace, the pigeon has long played a symbolic — and sometimes active — role.

Wendell Mitchell Levi, in his weighty book *The Pigeon*, wrote, "In the religions of early man, it held a place excelled by no other speechless creature. In martial strife, it has served its masters from earliest days. As a message-bearer in general, it had no equal. Poets, philosophers, and historians have extolled this bird."

Poets, philosophers, historians, and, in fact, most nonscientific writers have tended to use the terms "pigeon" and "dove" interchangeably and that's o.k. Pigeons and doves are both members of the family Columbidae and, as stated in the *Dictionary of Birds*, "no sharp distinction can be drawn between Pigeons and Doves, and in general literature the two words are used almost indifferently while no one species can be pointed out to which the word Dove, taken alone seems to be proper."

*The author's son feeding pigeons in Trafalgar Square*

The pigeon commonly seen strutting down train platforms and roosting high on city buildings is the Rock Dove, a bird that also travels under the names Street Pigeon and Blue Rock. It might be said that a pigeon by any other name coos as sweetly — or makes just as big a mess, depending upon your point of view. However, just calling the bird a "dove" seems to improve matters. Can you imagine referring to the "pigeon of peace"? Hardly.

Under both names, pigeon and dove, the bird's history has been linked with man's for thousands of years. As Levi pointed out, "Wherever civilization has flourished, there the pigeon has thrived." Archeological investigations have turned up carvings, inscriptions, and representations involving pigeons that date back thousands of years to the Sumerians, Egyptians, Greeks, and Romans.

It has been said that at the coronation of King Arthur of England four kings walked before him, each carrying a sword of gold, and four more kings walked before the queen, each of these carrying a white pigeon. At coronations in France large numbers of white pigeons were released to commemorate the happy occasion.

In more modern history, Samuel Pepys added a pathetic note when he included the pigeons in his description of the Great Fire of London, saying, "Among other things the poor pigeons, I perceive, were loth to leave their homes, but hovered about the windows and barbuies till they burned their wings and fell down."

Wars stud the pages of history books and, although they are seldom mentioned, pigeons have been effective military allies since ancient times. Carrying messages to and fro, homing pigeons were used by Julius Caesar in his conquest of Gaul and by many generals over the years, but really flew into their own on an international basis following the Franco-Prussian War. During the siege of Paris (November 1870 to January 1871) pigeons flew to Paris from other cities bearing thousands of messages.

Although you might assume that advances in communications techniques would have outmoded the homing pigeon by the time of World War I, this was not so. Telephone or telegraph wires could be tapped or cut; rockets or flares become impractical, but the pigeon flew on. Major General Fowler (an amazingly appropriate name), chief of the British Army's Department of Signals and Communication, was reported as saying: "When troops are lost, or surrounded in the mazes on the front, or are advancing and get beyond known localities, then we depend absolutely on the pigeon for our communications. Regular methods in such cases are worthless and it

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*Patricia Williams is managing editor of scientific publications.*

is at just such times that we need most messengers that we can rely on. In the pigeons we have them. I am glad to say they have never failed us." It has been estimated that from 20,000 to 500,000 feathered fighters served all forces in World War I.

Again, in World War II, pigeons were active participants and in the United States the Pigeon Corps numbered 3,000 enlisted men, 150 officers, and 54,000 pigeons. G. I. Joe, the best-known American pigeon hero of this war, was stationed in Italy when he flew 20 miles in 20 minutes to stop allied planes from bombing a village just taken by British infantry troops. The planes' motors were warmed and they were ready to take off when G. I. Joe flew in with news of the take-over. The speedy pigeon was decorated by both the Americans and the British.

Most recently, pigeons were field-tested in Viet Nam to serve in an ambush-detection system. Each trained pigeon was equipped with a small transmitter that emitted a steady signal as the bird flew ahead of a convoy and watched for concealed humans. If the bird saw anyone lying, kneeling, or hiding off the road, it was trained to land. When it landed, the transmitter's signal stopped and the convoy was warned of potential danger.

In contrast to its role in wars and despite the fierce and bloody battles which occur between males, doves are popular symbols for valentines, wedding cakes, and poems of love. Of course, not only do doves bill and coo as lovers do, but they are — even in this time of rising divorce rates — believed to mate for life.

Doves are connected with both Venus and Aphrodite, mythical goddesses of love, and literature is filled with allusions linking the bird and love. Shakespeare often refers to pigeons and doves in his plays and, for example, has Rosalind say to Orlando in *As You Like It*, "I will be more jealous of thee than a Barbary cock-pigeon over his hen."

Elizabeth Barrett Browning was very fond of doves and was known to present friends with pairs of the loverlike birds. Tennyson often included pigeons in his poems, but certainly the most sentimentally romantic pigeon-poem must be *Verses Written in a Garden* by Lady Mary Wortley Montague:

> See how that pair of billing doves
> With open murmurs own their loves
> And, heedless of censorious eyes,
> Pursue their unpolluted joys:
> No fears of future want molest
> The downy quiet of their nest.

Kamadeva, the Hindu god of love, is represented with a dove for his steed and, cupid-like, is armed with an arrow of flowers and a bow whose string is formed of bees. Not only Hinduism, but many of the world's religions have employed pigeons and doves in rites and as symbols. Ingersoll, in his book *Birds in Legend Fable and Folklore*, points out that the dove, "by which is meant the prehistorically domesticated blue rock-pigeon, almost deserves a chapter to itself" and he proceeds to almost give it one, tracing the bird's history "back to the misty dawn of civilization and religion in Mesopotamia, the Garden-of-Eden land, where arose the dual 'nature-worship' of the combining elements heaven and earth, male and female."

## *G. I. Joe, the best-known pigeon hero of World War II, was decorated by both the Americans and the British*

Mohammedans hold the pigeon in reverence and Levi states that "as recently as 1925 a near riot was caused in Bombay when two European boys ignorantly killed some street pigeons. The stock exchange and general market were closed and a widespread strike threatened."

References to pigeons abound in both the Old and New Testaments of the Bible. While many of those in the Old Testament concern the pigeon as a sacrificial offering, the bird plays a more active role in the story of Noah and the deluge. Noah sent forth a dove to see if the flood waters had subsided. On the first attempt, "the dove found no place to set her foot, and she returned to him in the ark, for the waters were still on the face of the whole earth" (Genesis 8:9). After a time, Noah sent the dove out again "and the dove came back to him in the evening, and lo, in her mouth a freshly plucked olive leaf; so Noah knew that the waters had subsided from the earth" (Genesis 8:11). This must certainly be the best-known example of the pigeon's trustworthiness and homing instincts.

In the New Testament, scripture states that on the occasion of Jesus' baptism by John the Baptist, "he went up immediately from the water, and behold, the heavens were opened and he saw the Spirit of God descending like a dove, and alighting on him" (Matthew 3:16). It is this reference that has inspired so much Christian art over the centuries. The Holy Spirit is depicted as a dove in stained glass windows, paintings, tapestries, and sculpture. Similarly, the spirit of man, or the soul, is also represented by the dove in various art forms.

There are many stories concerning the multitudes of pigeons in St. Mark's Square in Venice and one of them asserts that the birds fly three times daily around the city in honor of the

Trinity. Another story which offers an explanation for the great numbers of pigeons in the square holds that at one time it was the Palm Sunday custom of the clergy of St. Mark's to release pigeons fettered with little screws of paper to prevent their flying high. The people scrambled for the disabled birds and caught many of them. A few, stronger than the rest, managed to escape and fly to the safety of rooftops around the square. These sturdy high-fliers were, according to one writer, "regarded as sacred forever with their descendants" and the state provided them with food.

Why do people enjoy feeding the pigeons? In 1887 the ardent English pigeon-fancier Rev. J. Lucas tried to explain, "I have seen men of the careworn face and restless eye pause in the courtyard of Guildhall and watch them. Their anxious features relax into a smile; they become interested and amused at the docility and dignity of the birds, whose composure in the midst of a throng of pedestrians is exquisite."

Alright. The pigeon is obviously a bird to be reckoned with: a war hero, religious symbol, and romantic model. Further, pigeon breeding and racing has given pleasure to hobbyists for centuries; the bird has served as a medium for scientific research in the study of genetics, disease, and nutrition; and squabs (young pigeons from one to about 30 days old) are enthusiastically enjoyed as food. All very commendable, but, still, there are those who just don't have a good word to say for the bird. Why not?

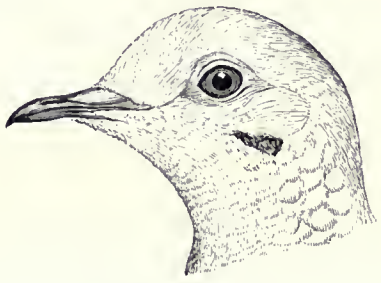
*Pigeons in St. Mark's Square, Venice, 1887*

Although Chicago now has no central pigeon hangout to rank with St. Mark's or Trafalgar Square in London, the city's fairly new Civic Center seems to be a likely candidate. Already popular with the birds, the vast open square has ample room for soaring and wheeling between buildings, a large monument for staining, and a sizeable crumb-tossing population. Until her death in December, 1978, "the Pigeon Lady," a small, white-haired woman shod in tennis sneakers, was a familiar sight in downtown Chicago as she fed bread crumbs to the birds.

Well, there are several reasons — and good ones, too. In September 1963, the *Chicago Daily News* complained "It seems to us that the pigeon feeders are about the only people allowed to keep their pets at large." In reaction to a New York City

health department study which showed that the average New Yorker inhaled 3 micrograms of droppings daily — courtesy of that city's five million pigeons — the *Daily News* editorialized, "It may be a good idea to keep flocks of pigeons around on the off-chance that the next Depression will get really desperate, but in the meantime they are a frightful, filthy nuisance. . . ."

If during a "desperate Depression" you eat a wild street pigeon, you may get more than you bargained for. Although a pigeon may seem to fly overhead in solitary splendor, it is not really alone. Austin Rand, former chief curator of zoology at Field Museum, wrote, "The bird is like an island with its own flora and fauna, carrying at least some of the 70 or so plants and animals that have been recorded as living on or in the domestic pigeon. These include two species of ticks, eight of mites, a fly, a bug, six lice, nine roundworms, eighteen tapeworms, three flukes, eight protozoans, two fungi, nine bacteria, four viruses, and doubtlessly many others." He went on to state that "A thousand tapeworms have been found in the intestines of a single pigeon, 30 pigeon flies among the feathers of a single bird, and 20 lice on a single feather."



*Mourning dove*

Not surprisingly then, feral pigeons have been indicted as transmitters of disease and have been a source of continuing interest to the U.S. Department of Health, Education and Welfare. Pigeons are known to be carriers of encephalitis, for example, and the disease is transmitted from birds to man by mosquitoes. Some other pigeon-related diseases are pigeon ornithosis, Newcastle disease, aspergillosis, thrush, salmonellosis, cryptococcosis, and histoplasmosis.

Pigeon droppings garner the most complaints and cause the greatest number of problems. Dr. H. C. Scott of the U.S. Communicable Disease Center ran up a short list of problems caused by pigeon droppings: "Pigeon droppings deface and accelerate deterioration of buildings, statues, and automobiles, and may be deposited on unwary pedestrians. Large amounts of pigeon excrement may kill lawns and shrubbery. In addition, pigeon droppings, regurgitated pellets, feathers and nesting material are common contaminants of grain destined for use as human food."

The Armed Forces Pest Control Board has cited the great number of man hours needed per year to clean up and repaint government installations as a result of pigeon fouling. Further, at airports bird droppings on helicopter rotor blades can cause the blades to be unbalanced. This, in turn, causes a severe vibration when the engine is readied for take off.

Pigeon nests, too, get their share of negative reaction as they clog drain pipes, interfere with awnings, and make fire escapes hazardous. Mites and insects residing in pigeon nests on window sills and building ledges may easily enter and infest the host building.

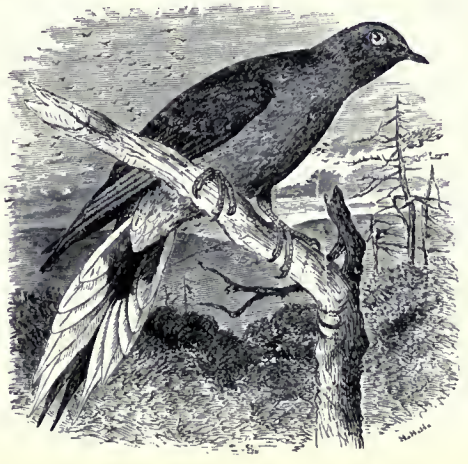
An industry devoted to the repelling and barring of pigeons does a lively business as a result of the bird's untidy practices. Workers for these firms, however, often report that they are harassed as they go about their jobs by irate pigeon admirers.

Dr. Rand's tally of pigeon residents, listed above, inspired Carl S. Miner to compose the following poem with which many of us may sympathize:

Till now when I saw pigeons fly
Away up yonder in the sky
I much enjoyed their graceful motion.
Then I had not the slightest notion
That they were hosts to noxious things
That crawl or creep or fly on wings.
Now when I see them overhead
I'm filled with fear, also with dread,
Of what might happen. So in fright
I pull my hat down very tight.
Knowledge is power, but sometimes it
Limits enjoyment quite a bit.

Here you have both sides of the pigeon issue: dirty bird versus noble creature. The choice is up to you. Just remember this word of warning: You may choose to admire the pigeon, but never look up to it. □

*The late, lamented passenger pigeon, cousin of the Rock Dove*



# Adult Group Programs

*BY* LINTON PITLUGA

Thursday, April 20, 1978. The time: 9:45 a.m. The first group of the day is just arriving at Field Museum; they leave the bus and enter the West Door. The group of 33 has been traveling since nearly 7 a.m. and they look slightly dazed from the droning of the bus. They welcome the end of the ride and the chance to shake off traveler stiffness.

A museum volunteer greets the group and confers briefly with the leader. The rest of the group, unoccupied for the moment, forms into clusters to engage in revitalized conversation. The cavernous classic Greek lobby echoes with their voices. They are then invited to leave their wraps in the nearby coat closets. Some use the restrooms. The others are encouraged to enter the A. Montgomery Ward Theater for the slide lecture, which will begin as soon as all are seated. They are greeted by lecturer Bob Feldman, a Field Museum research archeologist.

At 10:05 a.m. the slide lecture begins. It will last nearly an hour. At about 11 a.m. the volunteer for this group returns to escort them to Hall 26 where they will see what they came for: Gold. Artifacts fashioned from gold are here in quantities that would astound even the conquistadors, comprising the temporary exhibit, *Peru's Golden Treasures*. Like the *Treasures of Tutankhamun* exhibit, which visited Field Museum in 1977, *Peru's Golden Treasures* seems to possess a magic that renders all other exhibits pedestrian.

This is only one of the 15 adult groups, totaling 654 people, to visit Field Museum on this Thursday. Some will visit the Peru gold exhibit only briefly, while others will have arranged for a slide lecture, an audio tour, and even a catered meal in one of the Museum's private dining rooms. Three shifts of staff and volunteers will be on hand to greet and escort, and to ease each party through its schedule. Some staff and volunteers will still be at the Museum at 10 p.m. when the last groups are leaving.

Why did the groups come? Probably for a variety of reasons. Some, like the group from the University of Wisconsin at Green Bay, came for academic reasons; as did the group from the Lakeview Museum in Peoria. Others, from women's clubs, churches, travel agencies, social clubs, and corporations, came for the cultural enrichment of the experience, and also because such visits provide an interesting and unusual social experience.

In recent years, there has been a growing realization at Field Museum that a special need exists for programs and services designed specifically for adult groups. Certainly, a number of special temporary

*Linton Pitluga is group resource coordinator, Department of Education.*

*The Pawnee earth lodge is an exciting highlight of the* American Plains Indian *program for adults. Volunteers present a program about Pawnee culture. The sculpted figures shown here stand upon the roof of the lodge.*

*Special temporary exhibits such as* Peru's Golden Treasures *have proven particularly popular with adult groups.*

exhibits, such as the *Treasures of Tutankhamun*, have attracted sizeable numbers of such groups, but what would happen if an ongoing selection of programs featured Field Museum's permanent exhibits? Now, with funding from the National Endowment for the Arts, Field Museum is finding the answer to this question. Since July 1977 a selection of adult group programs have been under development. These programs, described below, last for about an hour and a half and include a slide presentation and a guided tour of exhibits.

### Life in Ancient Egypt

This program, which draws upon the Museum's superb Egyptian collection presents the unique culture of ancient Egypt as reconstructed and interpreted from artifacts found in the Nile Valley. The artifacts are viewed in the rich setting of the newly renovated Hall J.

### The American Plains Indian

Before the arrival of Europeans, the Great Plains were only sparsely populated by the Indians. After the introduction of the horse from Europe, the plains became a source of plenty, and Indians migrated there from regions where game and other life staples had become more difficult to come by. Then the white settlers arrived and much of the game—notably the buffalo—was no longer abundant, and a radical change of Indian lifestyles came about.

Groups explore these cultures of the American plains Indian during the time that they flourished. Highlights of this program are a tour of the Pawnee Earth Lodge (a full-scale replica of a Pawnee dwelling) and the outstanding exhibits of art, clothing, personal and religious articles, and weaponry of the plains Indians.

### The Weaver's Walk

Well before the dawn of history, inhabitants of this planet had mastered the art of interlacing strands of fibers together to create cloth. Since then, a rich variety of weaving techniques and textiles has been created. *The Weaver's Walk* explores this development and includes Field Museum's fine collections of exquisite textiles produced for costume and decoration by cultures around the world.

### Special Temporary Exhibits

Each year Field Museum hosts a number of special temporary exhibits, which adult groups are invited to tour. Group reservations are now being accepted for *Feather Arts: Beauty, Wealth and Spirit from Five Continents* (see December 1978 and February 1979 Field Museum *Bulletins*). This exhibit, which opened February 15, will be on view until June 15. A special slide lecture by Phyllis Rabineau, costodian of collections, Department of Anthropology, may be arranged in conjunction with an Armchair Expedition. Other temporary exhibits to be featured in 1979 include *Art of the Huichol*, May 5 to September 3, and *Treasures of Cypress*, June 14 to September 16.

### Dining at Field Museum

Many Museum visitors, accustomed to the culinary pleasures of Chicago's fine restaurants, have also been pleasantly surprised by the high quality of Field Museum's cuisine, served in private dining rooms. With a range of attractive prices, a special selection of menus is available for breakfast, luncheon, and dinner. The menus include such delights as boned breast of chicken Kiev, roast prime rib of beef au jus, and delicate broiled fresh whitefish. For light meals, the crab bisque with date-nut finger sandwiches and French pastries are among the many items. An afternoon tea and a wine and cheese buffet may also be arranged as part of an Armchair Expedition.

# CHINA

## A PHOTOGRAPHIC PORTFOLIO

*BY* STANTON R. COOK

In 1977 Field Museum Trustee Stanton R. Cook, chairman and publisher of the *Chicago Tribune*, toured China with a group of other Associated Press directors. During their 16-day visit they traveled to Peking, in the north; Shanghai, and Hangchou, on the central coast; Ch'ang-sha and Kweilin, in south-central China; and Canton, in the south. They also spent time in Inner Mongolia, a region which Western visitors have rarely been privileged to see.

Armed with two Nikon cameras, Cook took hundreds of photos of contemporary Chinese life—laborers, school children, artisans, dancers, street vendors, even horsemen in Inner Mongolia. The result is a remarkably vivid portrait, a sampling of which we see on these pages. Photos courtesy *Chicago Tribune*.

*Countryside outside Kwei-lin, praised in many poems, is famous for its superb landscape. Town was founded in 214 B.C., is now becoming industrialized.*

Upper left: *Like the man on this month's cover, this youth is a resident of a commune in Inner Mongolia, some 250 miles west of Peking.*
Upper right: *Work was begun on the Great Wall during the reign of Huang Ti, more than 2,000 years ago.*
Left: *Sign painters on Orange Island, not far from the city of Ch'ang-sha, in south-central China.*
Facing page, top: *Part of the Temple of Heaven, in Peking, first built in 1420. The message reads: "Grab hold of revolution. Increase production. Work hard. Get ready for the war. Improve effectiveness in all aspects of endeavor."*
Right: *An artisan does cloisonne in the Peking Arts & Crafts Factory, in which 1,300 men and women produce goods for export. The average salary: $22.50 per month.*
Far right: *Dancers who stopped to perform at the Li An Tuge commune, in Inner Mongolia.*

要抓革命促生产，促工作，促战备，把各方面的工作做得更好。

Above: *Looking across Kunming Lake to the slope of Wan Shou Shan, site of the summer palace of the Chin dynasty, six miles from Peking.*

Left: *Monument to the People's Heroes in Peking.*

Facing page, top: *Ceiling in Summer Palace, just outside Peking.*

Right: *One-third of a primary school student's time is spent learning characters. About 1,500 characters are needed to be literate, but only about 5,000 of some 50,000 are in regular use.*

七星岩

Left, above: *Entrance to cave at Kweilin*

Left, below: *Peking school children sing in Tien An Men Square, day before one-year anniversary of Chairman Mao's death.*

Above: *The face of young China reflects optimism and, here, perplexity.*

Right: *Bridge to Kunming Lake, near Peking. In winter, the lake's ice is cut into chunks and stored for summer use.*

# *Of Land Bridges, Ice-Free Corridors, And Early Man In The Americas*
## Part II

BY GLEN COLE

*Artwork by Louva Calhoun*

*The previous installment of this article (January, 1979,* Bulletin*) considered the Bering Land Bridge and the late Wisconsin ice-free corridor across Canada—the land bridge as the obvious route by which Asians moved into North America and the corridor as a route for people moving between Beringia and the mid-continent. It was seen that a feasible passageway through this corridor probably did not exist until after 13,000 B.P. (before present).*

*Nevertheless, there is good evidence that humans were living south of the ice sheet by 15,000 B.P.; much more tenuous is evidence suggesting that Early Man may have been in mid-continental North America considerably before that.*

*A big game hunting economy with a specialized stone and bone technology appeared in North America south of the late Wisconsin ice boundary around 12,000 B.P.. Attention will be directed here to this well documented Paleo-Indian occupation, which was the main focus of the AMQUA (American Quaternary Association) sessions devoted to the peopling of the New World.**

Curiously, much of the debate on Paleo-Indian origins hinges upon a single distinctive kind of artifact, the Clovis projectile point, which readily identifies this early cultural horizon. However, this artifact creates problems when it comes to searching for antecedents. The Clovis point has not been found in the Old World. It seems to have been an American innovation after the time when free interchange across the Bering Land Bridge occurred. Much weight tends to be given this artifact type by many of the investigators who have examined Asian materials for sources of the Clovis culture. It is generally supposed that the kinds of stone tools—if not actual fluted points—made by the ancestors of the Paleo-Indians should include forms which anticipate such points. As nothing reminiscent of fluting has been found, many students of Early Man in the New World suppose that stone working traditions that include "bifaces" (foliate or lanceolate artifacts shaped by removal of flakes from both surfaces or faces) would be appropriate as possible sources.

Despite the fact that the Clovis point comes in a variety of sizes and shapes, it is easy to recognize and is an excellent horizon marker. This is largely because of the distinctive fluting. Fluting is a technique of trimming the central portion of a point at its basal end, probably to facilitate the attachment of a shaft. This is done by removing one or more shallow flakes from the butt end in the direction of the point. The fluting, which may be on one or both faces, usually does not extend more than half the total length and it may be much less than that. The fluting technique was eventually so perfected that a single fluting flake might remove the entire central portion of a point for much or all of its length. These later artifacts, which also tend to be smaller and more delicately trimmed, are known as Folsom points, after a site near Folsom, New Mexico.

Clovis points have been found over most of North America beyond the limits of the late Wisconsin ice, including all of the contiguous 48 United States. For some 50 years it has been known that these fluted points are of considerable antiquity, since they have been found with the bones of extinct Pleistocene mammals. It was the evidence of fluted points found with the bones of an extinct bison species at the Folsom site in the late 1920s which led to the abandonment of the widely held opinion that man had been in the New World for only a few thousand years. With the advent of radiocarbon dating, the actual extent of that antiquity has been measured and, surprisingly, it has developed that Clovis points, when found in datable contexts, cluster within a relatively narrow time span; nearly all of the securely dated finds occur between 11,500 and 11,000 B.P. The Folsom variety of fluted point is dated to a rather longer period, from about 11,000 to 10,000 years ago.

The Clovis culture is best known from sites in the central and southern Great Plains, especially in the Llano Estacado, because there Paleo-Indian artifacts were first found in stratified contexts. Such was the case at Blackwater Draw, near Clovis, New Mexico. Here there had been a large

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**To avoid confusion, the term "Paleo-Indian" will be used here to apply only to these big game hunters whose tool kit was characterized by fluted projectile points.*

*Glen Cole is curator of prehistory. He describes himself as "an Old World prehistorian who is generally concerned with a much earlier time period than is covered in this article." Cole is, additionally, a charter member of the American Quaternary Association (AMQUA) and has followed with interest studies relating to Early Man in the New World. In this article he discusses recent developments in North American Early Man studies as presented at the 1978 biennial meeting of AMQUA at Edmonton, Alberta.*

spring-fed pond which served as a water hole for end-Pleistocene and early Holocene animals. For this reason it was attractive to the Paleo- and later Indians, who hunted and camped there on occasion for several thousand years. Clovis points and other artifacts were found in sands overlying gravels which were the aquifer for the pond. It was during the quarrying of these gravels that evidence of Paleo-Indian occupation was discovered. Folsom material occurred in more recent, higher-lying deposits. Unfluted projectile points, otherwise similar in size and shape to those of the Clovis and Folsom cultures, were found at still higher levels. No archeological material has as yet been found stratified beneath a level of Clovis artifacts.* Clovis points are sometimes found in association with other artifacts. For example, Clovis hunters, at least on some occasions, would camp close enough to a slain elephant or other animal so that butchering tools and other implements used about the camp might be associated with points included with the skeletal remains.

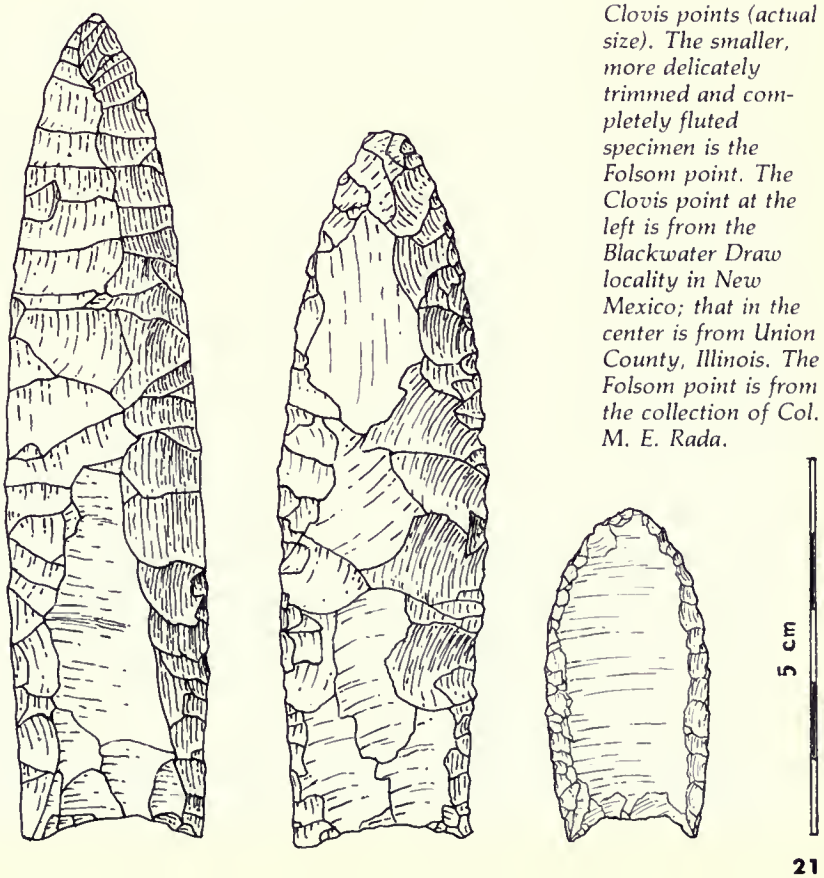
Clovis points have also been found—and in considerable abundance—in more easterly portions of the United States; less frequently they have been found in the western states and in northern Mexico. Unfortunately, nearly all of the eastern finds have been from the surface or have been turned up from superficial deposits by plowing and other surface disturbances, so they are devoid of context and cannot reliably be dated. Radiocarbon dates from sites in several eastern locations are consistent with those from the more westerly sites.

Vance Haynes, a University of Arizona geologist and geochronologist, while recognizing possible regional variations in the Clovis tool kit, and noting considerable variation in size and shape in the projectile points, suggested that "the basic Clovis tool kit was essentially the same wherever it is found. . . . This implies a high degree of mobility and lack of dependence on a restricted environment."** In this view, the Clovis hunters wandered over extensive areas in search of large game animals, especially elephants.

But some investigators doubt that an immigrant population could have spread so rapidly; they attach more weight to the apparent regional variations. Dennis Stanford, a Smithsonian Institution archeologist, sees "Clovis as a technology diffused within a population already inhabiting the New World." He suggests that the technological concepts necessary for the fashioning of Clovis points—whether introduced from Asia or derived independently—"spread to populations already exploiting a variety of environments." Similarly, Robson Bonnichsen, a University of Maine archeologist, sees in Clovis points "structural patterned variation of shape and technological attributes [which] appear to occur on a regional basis." He thinks this would not be so "if these points represent a single migration."*

Haynes has observed that "the spread and development of the Clovis culture throughout North America and northern Mexico took place during a period of the greatest environmental

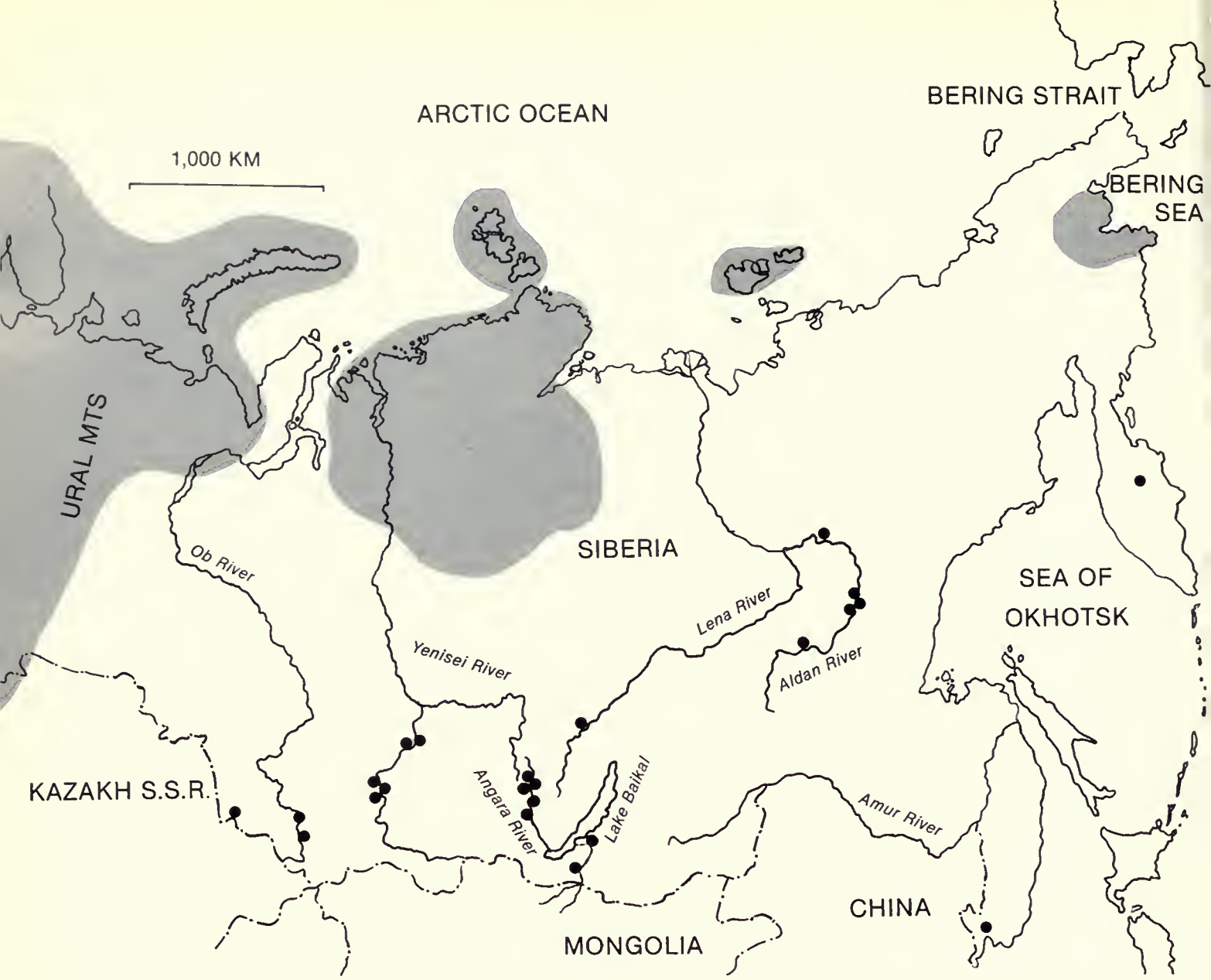
*These days migrations are not in favor with most anthropologists, including those who practice archeology. This is not to say that anthropologists deny the occurrence of migrations in human history and prehistory but it is certain that such have often been misused as easy "explanations" for observed cultural distributions. It is a good deal simpler to dismiss discontinuous distributions of cultural traits and complexes as a result of migrations than to try to understand them in terms of complex interactions between social, economic, and environmental factors which are unquestionably much more important in the overall picture of human cultural development.*




*A Folsom and 2 Clovis points (actual size). The smaller, more delicately trimmed and completely fluted specimen is the Folsom point. The Clovis point at the left is from the Blackwater Draw locality in New Mexico; that in the center is from Union County, Illinois. The Folsom point is from the collection of Col. M. E. Rada.*

*At the Meadowcroft site, artifacts older than 12,000 years B.P. occur in a stratified sequence, but no Clovis material seems to be present nor, apparently, have any other kinds of artifacts been reported in the 11,500 to 10,000 years B.P. time period. Also, last year, artifacts found below an occurrence containing fluted points of the Folsom variety were reported from a site in northwestern Missouri. These artifacts are not of a kind that could be regarded as part of the Clovis tool kit. The excavators estimate that the material must be older than 15,000 years B.P.*

**All quotations, unless otherwise indicated, are taken from the Abstracts of the fifth biennial meeting, American Quaternary Association, Edmonton, Alberta, 1978.




*Distribution of important late Pleistocene Siberian sites. The clustering of sites near population centers in major river valleys is a better indication of the activities of prehistorians than distribution of prehistoric populations. Nevertheless, prehistoric human activities probably were concentrated in the river valleys and sites certainly have been better preserved there; so future discoveries can be expected to extend the range of sites into unexplored ranges of river valleys to a greater extent than elsewhere in Siberia. The shaded areas indicate positions of the more important late Pleistocene ice sheets.*

change since the end of the Sangamon interglacial" (the interglacial which preceded the Wisconsin). He notes that ". . . major vegetation changes occurred locally and regionally, there were marked changes in erosional-depositional processes and hydrology, and many forms of Pleistocene animals became extinct." As a geologist, Haynes is interested in the causes, effects, and interrelationships of these factors. Bonnichsen, as an anthropologist, emphasized in addition that this was doubtless "also a period of cultural stress marked by new innovations—man's primary way of readapting." As an alternative to the hypothesis that the Clovis culture was brought by migrants from Beringia, he proposes that the introduction of a single hunting tool, the atlatl* and its attendant stone-working technology (pressure flaking and, perhaps, heat treatment of stone to improve its flaking properties) could have diffused rapidly to pre-existing populations. Such rapid diffusion of these generalized innovations could account for the sudden appearance of Clovis and other fluted points throughout the Americas. Also, as the realization of the more sophisticated hunting tool would have been left to craftsmen practicing regional technologies and influenced by local styles, one can account for the regional variations which Bonnichsen sees in Clovis projectile points.

Once the matter of fluted points and their antecedents is put aside, many students of Early Man in the New World have no difficulties in find-

**The atlatl is an implement devised to add propulsive force to a thrown spear or dart. It is a rod or board shaped for gripping at one end, with a device designed to engage the butt end of the dart shaft at the other. The use of the atlatl implies the use of a special kind of dart, perhaps compound with one or more shaft components armed with a bone or stone point. The use of this implement doubtless facilitated the hunting of the thick-skinned mammoth. The atlatl was eventually replaced by the bow and arrow in most of North America but its use lingered in certain cases, as with the Aleuts and Eskimos, until historic times.*

ing similarities between Clovis cultural material and its context and that of certain Eurasian sites. Haynes cites a number of traits, including kinds of artifacts, stone- and bone-working technologies, and certain site features, and notes the similarity to those of sites from Siberia's Lake Baikal area and further west along the Yenisei River. He suggests that "to invoke independent development of all these traits in the New World from a population base for which there is only tenuous evidence does not seem as reasonable as does an origin from the Siberian Paleolithic during a time when the Arctic-Steppe biome existed on the Beringia platform." Further, Haynes thinks there may have been "a close temporal link between the Clovis culture and its Old World antecedents." However, he is hard pressed to find suitable antecedents in Beringia; he suggests, nonetheless, that the Clovis culture developed from one of two contemporary traditions there before 11,000 B.P.

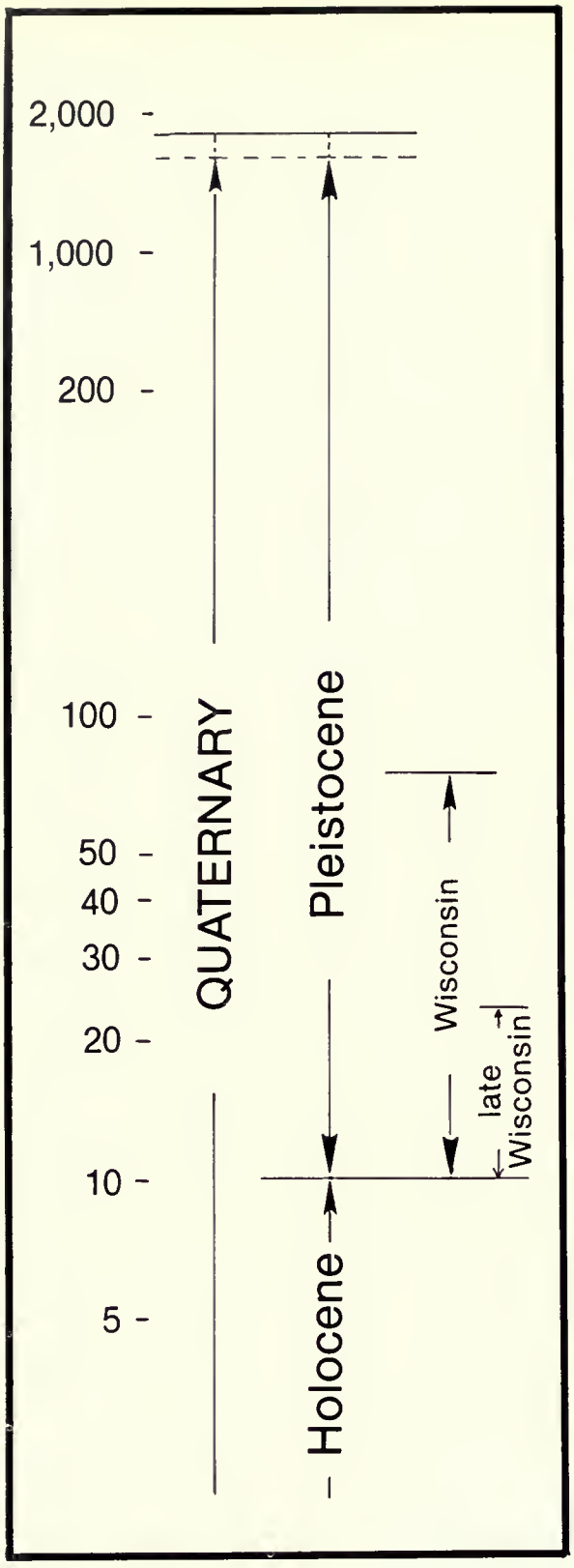
Whether or not the immediate antecedent of the Clovis culture was imported in toto or whether it is the result of the introduction of a new hunting tool with its attendant technology to an indigenous population, there seems to be general agreement that there was some movement of people around 12,000 B.P. As one AMQUA discussant, Donald Clark of the Archeological Survey of Canada, pointed out, previously unoccupied terrain was becoming available with climatic amelioration and retreat of ice. That is, if contact was established between populations in eastern Beringia and the mid-continent, people would have had to move into the intervening area; but, it should be noted, people living south of the late Wisconsin ice could have moved north as well as vice versa. So far, none of the very few dated fluted points from Alaska have proved to be as old as some of the Clovis points from south of the ice limits. Many investigators thus argue that the technology associated with the Clovis point was developed in the south, then moved northward as climatic and geographic conditions permitted. Those who are inclined to see the Clovis culture as introduced by an infusion of people from Beringia feel that it is merely a matter of time before older fluted points will turn up in Alaska and the Yukon, since that area is scarcely known archeologically.

In any event, the prevailing opinion seems to be that people living in eastern Beringia in the waning phases of the late Wisconsin glaciation worked their way southward, very likely through an ice-free corridor; with them came the incipient Clovis culture, whether or not the distinctive fluted point had yet been developed.

Most students of Early Man in North America investigating possible Old World roots of the Clovis culture direct their attention to material from north Eurasian sites. (The main interest in the western Pacific Rim is as a source of possible earlier American populations.) One of these investigators, William Powers, a University of Alaska archeologist, cited cultural material from sites along the Aldan River in central Siberia. This includes bifacial points and knives dating to the 18,000-20,000 B.P. time range. A technology for the production of long thin flakes, or blades—another characteristic of the Clovis tool kit—is also present; and it may be that certain aspects of the Siberian ivory and bone technology, *e.g.*, atlatl dart foreshafts, also appear in the Clovis culture. Otherwise, the similarity to the Clovis tool kit is not striking. Unfortunately, the tool kits from Alaska that most closely resemble this Aldan River material lack the bifacial points. In the Alaskan case, simple stone projectile points seem to have been replaced by composite tips comprised of laterally grooved bone points armed with inset microblades.

Many investigators favor the idea that there occurred multiple migrations of people into North America via Beringia, while others believe that there was a single incursion towards the very end of the Pleistocene. Powers favors the first position as does James Hester, a University of Colorado archeologist. Hester holds that separate migrations account for different cultural entities which he detects in the North American archeological scene. He sees these migrations as occurring "over a long period of time beginning as early

*Detail of diorama in Hall 4 demonstrating use of atlatl.*




*The Quaternary Period, which covers the last 1.6-1.8 million years of geologic time, is divided into two epochs, the Pleistocene and the Holocene. The last major glacial stage, ending 10,000 years ago, is known, in North America, as the Wisconsin. The Wisconsin, punctuated by several cold stadials and warmer intervals has been variously subdivided. For purposes of this article, it is simply divided into an earlier and a later portion. The more recent, late Wisconsin, will be that period from 23,000 before present (B.P.) to the beginning of the Holocene. The figures represent thousands of years.*

as 25,000 to 35,000 years B.P. and extending to a date as recent as 8,500 B.P." The Clovis culture would have developed from one of these migrations. The "single migration" position is held by many others. The prime advocate of this position who participated in the AMQUA symposium was Christy Turner, an Arizona State University physical anthropologist. Turner, who has studied dental characteristics of a wide range of people around the Pacific Basin, argued that "low dental and other biological variability of Paleo-, skeletal, and living Indians suggests the initial founding migration was singular, small, and late in the Pleistocene." He finds Paleo-Indian dental characteristics to be very much like those of living Indians, which suggests direct descent. The opinion of a majority of physical anthropologists who have studied the question is probably reflected in Turner's conclusion that "most of the ice-free New World appears to have been occupied by one people [via Beringia] . . . before the close of the Pleistocene."

Turner also detects evidence for another past population network with its New World distribution limited to the coastal areas of the northwestern and arctic portions of North America. This past population network extended "from north China through the Amur basin, along the Sea of Okhotsk and southern Beringia to at least the Gulf of Alaska. When rising seas forced the removal of these Beringians, their descendants, namely Aleuts, Eskimos, and possibly Northwest Coast Indians, were the Holocene 'migrants' to Alaska." This group would be that represented by Hester's last "migration." It should be noted that Turner is *not* arguing that the ancestral Aleuts and Eskimos migrated to the New World in Holocene times. Rather, they were stranded there, so to speak, early in the Holocene. Although it is possible that Hester's Holocene migration actually occurred, it seems more likely that these people were living in Beringia at the same time as the ancestral Paleo-Indians, much as Athabaskan Indians and Eskimos have co-existed in the American arctic and subarctic.

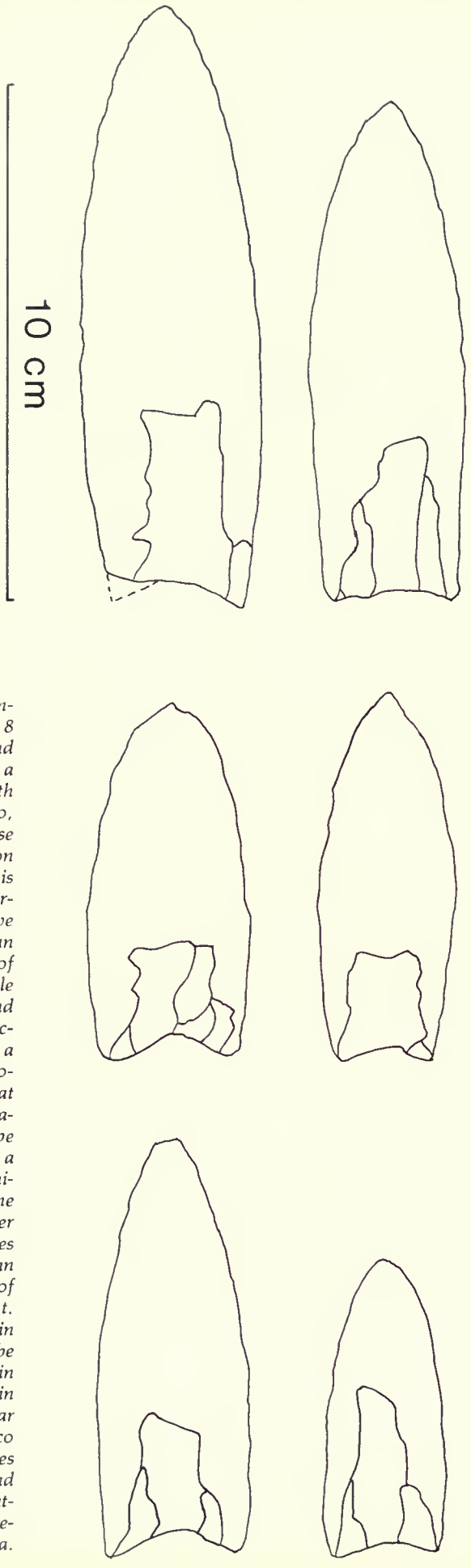
General, as well as some very specific, similarities in archeological material in northern Asia and Alaska have led many investigators to recognize a paleoarctic tradition which encompasses several variants. Don E. Dumond, a University of Oregon archeologist, has observed that it "seems clear that the Alaskan representatives of the Paleoarctic tradition hark back to the time when Alaska was a peninsula of Asia, thrusting against the continental ice of the New World."* Within such a model, Beringia would have been populated in the late Wisconsin by people adapted to the exploitation of different resource bases. One such base would clearly have been the large mammals living on the arctic steppe of Beringia; a second would

*Chapter 2 in* Ancient Native Americans. *J. D. Jennings, editor, 1978.*

*Map of North America indicating localities mentioned in the text. The shaded area indicates the Llano Estacado.*

have been the sea mammals and other marine life of the southern coastal biome. With the submergence of the central Beringian area, crucial evidence has been lost or has become inaccessible and it has not been possible to define the tool kits of the groups who exploited these resources. Despite the rudimentary state of terminal Pleistocene prehistory in Alaska, or perhaps because of it, the possibility of other variations has been suggested. Beringia was available for human habitation for a very long time so that regional variations had ample time to develop within these adaptations. It was the arctic steppe hunters, or some of them who did not use microblades, that Haynes viewed as likely antecedents of the Clovis population and culture. The Aleuts and Eskimos, in this view, would have descended from people adapted to life in the coastal zone, especially to the hunting of marine animals.

✳ Although some ancestral Paleo-Indian sites in eastern Beringia may have survived, any ancestral Aleut-Eskimo sites that existed before about 8,500 B.P. along former coastlines were submerged by the rising sea level at the end of the Pleistocene and early Holocene. In exceptional cases, high points occurred in the old land bridge and remain today as islands. Anangula, a small island just a mile or so from Umnak Island at the eastern end of the Aleutian chain, is such a case. Rather than retreat across considerable distances of gently shelving coastal plain before the rising water, people living there were able to move to higher ground locally. A low-lying portion of Anangula was occupied from ca. 8,700 to 7,200 years ago. Rising sea level finally caused this site to be abandoned. Continuing occupation of the island is found in another more recent site on higher ground. Although it may be that the 8,700-year-old occurrence represents the earliest Paleo-Aleut occupation, it is quite possible that older, lower-lying sites have been destroyed by the wave activity that has left a wave-cut terrace on the island — an earlier phase of the activity which is today destroying the older of the existing Anangula sites.




*Schematic representation of 6 of the 8 Clovis points found associated with a single mammoth skeleton at Naco, Arizona. All of these points are fluted on both faces. This association is particularly informative in that it provides an excellent example of the considerable variation in size and shape in the projectile points used by a single band of Paleo-Indian hunters or, at least, of the variation that can be expected within a restricted geographical area. If the points from other nearby Clovis sites are included, an even greater range of variation is evident. Although certain varieties may be more common in some areas than in others, forms similar to those from Naco and nearby sites have been found from widely scattered portions of ice-free North America.*

As is, perhaps, inevitable in a situation where so little factual evidence is available, a wide diversity of opinion has been expressed concerning the peopling of the New World. The following, though based largely on data presented at the AMQUA sessions, should not be taken as an attempt to present a consensus of AMQUA participants, nor of the anthropological contingent. In some cases I am unsure where a consensus, if any, might lie. These comments, rather, should be regarded as incorporating views which seem reasonable to an outsider—to an Old World prehistorian who lacks firsthand knowledge of the evidence.

In conclusion then, let us return to the several traditional questions posed at the beginning of the first installment: Where did the ancestors of the native Americans come from? How did they get to the New World? How long have they been here?

There is no question that the ancestors of the native Americans came from Asia, but this is not really saying very much. Apart from the ancestral Aleuts and Eskimos (who only figured in populating the extreme north and northwestern part of North America), it should be recognized that the peopling of Beringia is a question separate from that of peopling the New World. It is possible that people bearing different cultures, perhaps of varied genetic background, at one time or another, lived in Beringia. This would have depended on development of cultural paraphernalia adequate to cope with a severe subarctic and arctic environment. After all, Beringia was a large area available for a very long time —long enough to allow for the area to be occupied, abandoned, and reoccupied. Cultural differentiation could also have occurred within a once homogeneous population, and there was room enough for distinct populations to co-exist in their own areas of economic specialization.

Just when people actually did live there is another matter. The majority of datable Siberian sites have fallen into the 20,000-to-10,000-years-ago range. Radiocarbon dates from two sites along the Aldan River in central Siberia have recently been obtained for archeological material in the 35,000-30,000 years B.P. range. Undated material suspected of being older is also known, but this is from sites farther south and west in Siberia.

R. Klein, an Old World prehistorian familiar with the Eurasian evidence, has suggested that it was not until 35,000 or 40,000 years ago that Early Man had achieved the cultural capabilities necessary for living in the more continental portions of Europe where the most rigorous climatic conditions existed. He argues that it would not have been until some time later that these people would have been able to cope with the even more severe climatic conditions of northern Asia and to have reached its extreme northeast corner. If true, that would impose a limit on when the earliest immigrants from or via this area could have

entered Beringia. Klein suggests 30,000 years ago as a basement date. At the Siberian end of Beringia, however, nothing that early has been found. The oldest dates reported from the sparse information available from northeastern Siberia are on the order of 13,000 years ago. As one AMQUA participant observed, the best inferences that can be drawn on the nature of late Pleistocene occupation of northeastern Siberia are from evidence obtained from sites in Alaska and the Yukon.

The climate of Beringia during the later part of the Pleistocene was in general probably less severe than that of much of central and northern Asia. Conceivably, such conditions could have permitted the survival of coastal populations expanding their terrain northward and into Beringia. However, until the very end of the Pleistocene, there is no evidence for human occupation along the Pacific Rim north of the Amur River.

It could be that only those who occupied Beringia's eastern end and were on hand to take advantage of new land (including, perhaps, an ice-free corridor made available by retreating ice), provided the founding population for the Paleo-Indians. Whether or not anyone had managed to get into the New World south of the Wisconsin ice limits earlier is uncertain. But it does seem clear that if any did reach the mid-continent, they left no clear-cut archeological evidence; seemingly they contributed little if anything to the genetic constitution of the American Indian.

There is a consensus that Early Man came to the New World via Beringia; but there is no agreement as to the route or routes by which the early Americans gained access to the rest of North America. The AMQUA symposium was oriented towards the ice-free corridor, so there was no consideration given to possible alternate routes. The Pacific coast is one sometimes proposed; among less plausible routes suggested is the north Atlantic by means of boat from ice floe to ice floe. The ice-free corridor very likely served as a route by which people passed, one way or another, sometime around 12,000 B.P.; but we have no firm archeological evidence from the corridor itself for that period of time.

The question of greatest interest to most of those concerned with the peopling of the New World is *when* it occurred. Despite improved dating techniques, continued field work, and better knowledge of the Old World literature, we still don't have a very good idea of when the very first people reached eastern Beringia. Nor do we know when the first people reached the mid-continent or, if it was a different event, when the first viable population was established south of the Wisconsin ice limits. The evidence is good that Early Man was in Beringia at least 30,000 years ago, but not that it was continuously occupied from that time. However, apart from a few situations which for one reason or another are not entirely certain, claims for human presence elsewhere in the Western Hemisphere earlier than 15,000 years ago are dubious at best. Evidence has been accumulating to indicate that Early Man had become established somewhat earlier than the 12,000 years ago or so that until recently had seemed the best estimate. In at least one situation, there is good evidence for regional occupation through the period 12,000 to 15,000 years ago and there are a few other dates from scattered sites in the Americas that fall into that time range. If future geological work determines that the ice-free corridor opened earlier than is now thought or that it closed considerably later, a simple solution to some rather sticky problems will be at hand.

It may be wondered why some Quaternary scholars are so interested in determining just when humans established themselves in North America. For anthropological archeologists, the time that a viable human population was established could make a big difference in the way they regard the archeological data. In the case of the Clovis hunters we have seen that two quite different points of view are dependent upon the dating of this event. If the New World south of late Wisconsin ice limits was largely or entirely uninhabited when the bearers of the incipient Clovis culture arrived, the archeologist is then faced with this question: How did a small founding population spread so rapidly throughout the Western Hemisphere, adapting in the same short time to very different environments and developing considerable cultural diversity? On the other hand, if the Americas were populated before the Clovis culture appeared, the investigator is faced with another problem involving a different set of cultural processes: How did the late Pleistocene big game hunting complex come to appear more or less simultaneously in North, Central, and South America from a pre-existing population base that had previously followed quite a different mode of existence?

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One of several aspects of the AMQUA symposium not dealt with in this two-installment article concerned the post-Pleistocene dispersion of people throughout North America. For the reader interested in pursuing the subject further, *Ancient Native Americans*, edited by Jesse D. Jennings (W. H. Freeman, 1978) can be recommended. This book also covers Pleistocene peopling of the New World and provided some of the background information in these articles. *The Bering Land Bridge*, edited by David M. Hopkins (Stanford University Press, 1967), was another much used source of information and can be recommended.

Much of the literature concerning the late Pleistocene prehistory of Asia is to be found in scholarly journals such as *Arctic Anthropology*, which are not apt to be generally available. However, a useful book, *Northeast Asia in Prehistory* by C. S. Chard (University of Wisconsin Press, 1974) may be easier to locate.

# FIELD MUSEUM TOURS

## *Exclusive Tour Packages for Members and Their Families*

*Fabulous Machu Picchu, one of the sites to be visited on Field Museum's Peru tour.*

# PERU

IN 1978 FIELD MUSEUM was host to a dazzling exhibit of golden treasures from ancient Peru. Now Field Museum members and their families can visit some of the archeological sites where those treasures were discovered. A 20-day tour (Oct. 27-Nov. 15) will visit the famed ruins of Machu Picchu, Chan Chan, Pachacamac, Purgatario, and others. Also on the itinerary are the Plains of Nazca (viewed from low-flying aircraft), the offshore Guano Islands, and the famous Pisac Indian Fair. The group, limited to 20 persons, will be led by Dr. Michael Moseley, associate curator of middle and South American archeology and ethnology, and by Robert Feldman, assistant in archeology. Both Moseley and Feldman have done extensive archeological work in Peru; a tour escort will also accompany the group.

The tour cost—$2,998 (which includes a $500 donation to Field Museum)—is based upon double occupancy and includes round trip air fare between Chicago and Peru, as well as local flights in Peru. Delta Airlines will be used between Miami and Chicago, connecting with Aeroperu.

Deluxe hotel accommodations will be used throughout. The package includes all meals, including inflight meals; all sightseeing via deluxe motor coach; all admissions to special events and sites, where required; all baggage handling throughout, plus all necessary transfers; all applicable taxes and tips; all applicable visa fees. Advance deposit required: $250.00 per person.

**FIELD MUSEUM TOURS**

# COOK ISLANDS

THE UNIQUE OPPORTUNITY to see a hidden corner of the fabled South Seas awaits a select group of Field Museum Members. Accompanied by three staff scientists, from July 14 to 31, a visit to the Cook Islands will involve comfortable living in a still-unspoiled paradise. It will be the dry season, with clear lagoon waters, sunshine guaranteed, and comfortable temperatures.

For millions of years the tiny islands of the Pacific have undergone a cycle from birth as a volcano to death as an atoll sinking slowly beneath the ocean's surface. For a brief span of geologic time they stand as verdant mountains rising thousands of feet into cloud cover. Perhaps one, perhaps 10 million years later, they sink slowly into the water, with reefs formed from the bodies of billions of tiny animals and plants providing nooks and crannies for a profusion of marine organisms to dwell. Occasionally such a reef will become re-elevated, providing a honeycomb warren of caves and crevices with rich pockets of soil in which man can raise subsistence crops.

The Cook Islands, located between Tahiti and Fiji, and only recently serviced by jet aircraft, offer one of the last relatively undeveloped island areas. Rarotonga, the largest and youngest island with towering peaks and narrow valleys, is surrounded by a narrow, fringing reef and with small off-shore coral islands. A new, 150-room hotel provides a base with modern comforts. Aitutaki, only an hour away by small aircraft, is a classic atoll lagoon, rich in marine life and superb for snorkeling and scuba diving. There, a comfortable country-style motel provides accommodations right next to the lagoon reef, and the friendly, simple services of the Polynesian community. Mangaia, also a short flight away, is a raised reef island with small population and no tourist facilities. On a day's trip, transportation on a flat-bed truck or school microbus will supplement hiking into the raised limestone reef and journey to the lagoon areas themselves.

Accompanying this trip will be Dr. Alan Solem, curator of invertebrates, Dr. Robert K. Johnson, associate curator of fishes, and Dr. Elizabeth L. Girardi, research associate, Division of Invertebrates. Dr. Solem has traveled through many islands and published extensively on Pacific Island organisms, concentrating both on the native animals of the forests and reefs, plus the changes wrought by the accidental and purposeful introductions caused by human commerce. Through his eyes you will see the patterns of change through time, both before and since man's colonization of these islands.

Dr. Johnson, a certified SCUBA diver and expert on coral reef fishes, has led and participated in many diving expeditions in the Caribbean and Pacific. He will be in charge of SCUBA exploration on the outer reefs and deep lagoon areas, comparing and contrasting the fish and invertebrate communities as they vary from wave exposure, depth, and substrate types.

Dr. Elizabeth L. Girardi, on several trips to Australia and the Pacific Islands, has collected and studied shallow water marine invertebrates, particularly species of the fish capturing and eating cone shells. In addition, she has published on several native land organisms from the Pacific Islands.

There thus will be presented an overall view of Pacific Islands, their geologic and faunistic history, their contemporary diversity on land and in water, a view of the changes produced by man's habitation, all from the comforts of an international-class hotel, plus two nights on an atoll in simple comfort and a day on a little-visited island without tourist accommodations. The last three days of the tour will be spent in Hawaii.

The Cook Island tour group, limited to 25 persons, will travel via Air New Zealand. The tour cost—$2,650 (which includes a $400 donation to Field Museum)—is based upon double occupancy and includes round trip air fare from Chicago to the Cook Islands. The package includes all inter-island transportation, all meals (except lunches in Hawaii) and all inflight meals, all admissions to special events, where required; all baggage handling throughout, plus all necessary transfers, all applicable taxes, and tips. Advance deposit required: $400 per person.

*For full itinerary, additional details, and registration information, please write or call Michael J. Flynn, Field Museum Tours, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.*

# THE SOVIET UNION

*St. Basil's Church, Moscow*

***A travelogue** on the Soviet Union will be shown on Wed., March 28, at 7:00 p.m. in Dining Room E. Experts on the Soviet Union will be present to answer questions. Refreshments will be served.*

THE SPLENDORS OF OLD RUSSIA, the excitement of the New are in store for Field Museum Members and their families who join the tour "Treasures of Russia and the Ukraine," leaving Chicago's O'Hare Airport June 19 and returning July 8.

Highlights of the exclusive tour will include visits to the cities of Moscow, Vladimir, Kiev, Leningrad, Petrovorets, Novgorod, and Petrozavodsk. The group, limited to 35 persons, will be led from Chicago by a Russian-speaking lecturer and a Russian-speaking escort, with additional guides while in the Soviet Union provided by *Intourist* (the Soviet Travel Bureau).

The tour cost—$2.970 (which includes a $500.00 donation to Field Museum)—is based upon double occupancy and includes round trip air fare from Chicago to Moscow, with intra-Russian air transportation where required. The transatlantic airline is Swissair.

Deluxe hotel accommodations will be used throughout or, where necessary, the best hotels available. The package includes all meals, including inflight meals; all sightseeing via deluxe motor coach; all admissions to special events and sites, where required; all baggage handling throughout, plus all necessary transfers; all applicable taxes and tips; all applicable visa fees. Advance deposit required: $250.00 per person.

For full itinerary, additional details, and registration information for all tours, please write or call Michael J. Flynn, Field Museum Tours, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.

## *ILLINOIS ARCHEOLOGY FIELD TRIP*

For many of us, the word "archeology" conjures up visions of great architecture in distant places: Egypt's Pyramids and Sphinx, Cambodia's Angkor Wat, and Mexico's Pyramids of the Sun and Moon at Teotihuacan. These sites, with their relics, are limitlessly fascinating.

But right here in Illinois we also have exciting archeological sites, including the largest aboriginal structure north of Mexico—Monk's Mound at Cahokia. One of the most broadly based archeological research centers in the country is the Foundation for Illinois Archeology, at Kampsville; and one of the largest covered excavations with the longest continuing research programs is at Dickson Mounds, near Lewistown.

If you are interested in learning more about Illinois prehistory, as well as how scientific archeological research is conducted, you can join the Field Museum field trip of June 1-5, which will visit Dickson Mounds, Kampsville, and Cahokia Mounds. Limited to 30 participants, the trip includes site visits, lecture and slide presentations, workshops and discussions led by staff archeologists working at the respective sites. The field trip director is Robert Pickering, a doctoral candidate at Northwestern University.

For full itinerary, additional details, and registration information on the field trip, please write or call Michael J. Flynn, Field Museum Tours, Roosevelt Rd. at Lake Shore Drive, Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.

*Helton Mound, in the Lower Illinois River Valley, is typical of the type of site to be visited during the June archeology field trip.*

# OUR ENVIRONMENT

### Wood as Fuel

Doing a slow burn over high heating costs? Decided to save fuel dollars by turning to wood? The next logical question is, what to burn it in? Fireplaces, while decorative and romantic, have a meager efficiency of heat energy output of about 10 percent. In other words, the other 90 percent of the heat goes up the chimney. Controlled draft, metal stoves, on the other hand, boast an efficiency of 50-60 percent, but they vary greatly in heat-output capacity, steadiness and duration of output, tendency to form creosote deposits, safety, durability, and ease of loading.

Some antique stoves, such as the famous Franklin, are leaky and inefficient. But others, like the Art Sparkle, built in 1894 by the Portland Stove Foundry, contain intricate baffle systems which allow smoke to rise until it hits the top of the stove, then draws it down around the sides of the firebox, through a stove pipe in the back of the stove, and finally, out the flue. The stovepipe stays cool while the smoke circulates numerous times through the stove, which retains most of the fire's heat and disperses it into the room.

The masonry stove, or "Russian fireplace," is a closeable fireplace with a convoluted flue. Unlike a conventional fireplace, the masonry fireplace absorbs the heat into its mass. A variation, the Kachelofen wood (or coalburning) heater, features a central core of cast iron surrounded by a ceramic tile wall.

The single most important factor in a stove is the control of draft which regulates the crucial element, oxygen. In general, airtight units have higher combustion efficiency, and double (or smoke) chambers provide more surface area for heat transfer and more volume for better combusion. With these general principles in mind, wood stove buying still requires a great amount of homework and comparison shopping. Recent information indicates that more than 500 companies are manufacturing wood stoves in the United States, offering more than 2,000 models. To confound the situation, presently no standard safety requirements or installation regulations have been issued.

One good source of information on woodburning is *The Woodburner's Encyclopedia*, by Jay Shelton, a professor at Williams College and a pioneer in modern research on wood stoves. Shelton indicates that wood at $63 a cord is competitive with fuel oil at 50¢ a gallon (based on a wood stove efficiency of 50 percent and a furnace efficiency of 65 percent).

Wood is usually divided into two categories, hardwood or softwood, depending on its density. Softwoods like pine are less dense, thus have a lower overall energy content and contain more volatiles, so they burn with more flame. Hardwoods, mostly deciduous trees like oak and hickory, burn longer and hotter.

It is important to use dry wood, because "green" wood leaves a heavier creosote residue, a fire hazard. "Green" wood is heavier than dry wood because of the water content. How to tell? Two wet logs knocked together will resound with a dull thud rather than the sharper, ringing sound of dry logs. Also, freshly cut wood shows clear growth rings while dry wood will have darker-colored ends and cracks radiating from the center.

Look for a 12-14 inch base on a tree to yield about half a cord. Fall, and preferably winter, are good times to cut wood, allowing plenty of time for the wood to dry before the next season, and reducing the chance of sprouting. Most important, wood holds only a fraction of water in the winter that it does in summer.

If everyone turns to wood, will air pollution worsen? In large cities with dense housing, it is conceivable. But in suburban and rural area it has been found that woodburning poses fewer air pollution problems than coal and many types of fuel oil. The sulfur content in wood is low and although carbon dioxide is produced by woodburning, it is released in the same amount by naturally decaying wood.

Some volatile substances are released in the woodburning process, but what they are or what health problems they might cause are simply not known.

A decision to burn wood should be based on more than economics. It will likely involve some change in lifestyle although many profess that it is a satisfying, fulfilling change. It will likely involve manual labor—some splitting, stacking and hauling, and a strong constitution—to grab the longjohns on a cold morning and go downstairs to start or stoke a fire. For those who are less than purists, a conventional home heating system alongside a new, "old" wood stove has proved a more than happy compromise.

*—Carol Waite,*
*National Wildlife Federation*

| *Species* | *Available BTU's in one cord (in 1,000's)* | *Heat Value Rating* |
|---|---|---|
| Apple | 23,877 | 1 |
| Beech, Amer. | 21,800 | 1 |
| Hickory | 24,600 | 1 |
| Ironwood | 24,100 | 1 |
| Oak, white | 22,700 | 1 |
| Ash, white | 20,000 | 2 |
| Birch, white | 18,900 | 2 |
| Birch, yellow | 21,300 | 2 |
| Maple, sugar | 21,300 | 1 |
| Oak, red | 21,300 | 1 |
| Elm, Amer. | 17,200 | 2 |
| Maple, red | 18,600 | 2 |
| Tamarack | 18,650 | 2 |
| Aspen | 12,500 | 3 |
| Pine, white | 12,022 | 3 |

1=best
2=average
3=poor

### New Hope for Snake bite Victims?

Two Mississippi scientists may have found a new substance for treating snakebite victims that is much more effective than the treatments now in use.

Van Philpot of Houston, Mississippi, and Rune Stjerholm, a biochemist at Tulane Medical Center, have isolated the substance in the blood of pit vipers that prevents them from dying when bitten by their own kind. The isolation is believed to be the first ever.

Snakebite victims are currently treated with an antitoxin obtained from immunized horses. One problem with the current treatment is that roughly a third of the population receiving the antitoxin has allergenic reactions, which sometimes prove fatal. The antitoxin also isn't effective for water moccasin bites.

The new substance that has been isolated in the blood of the viper family would be effective for treating all viper bites, which include rattlesnakes, asps, bushmasters, copperheads, and water moccasins.

### Jogging Can Be Hazardous

A young man who was jogging near Old Faithful in Yellowstone National Park spotted a grizzly bear following him. When he stopped jogging, the bear came up to him, stood up, and slapped him once on each shoulder. The bear then ran off, leaving the jogger unhurt but surprised.

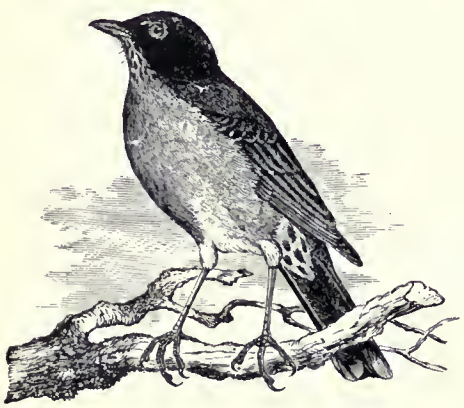
Eleven days later another attack occurred on a man jogging in Kansas City, Missouri. According to an AP report, the 185-pound jogger was knocked to his knees

by the attack, which left him with three scratches and four puncture wounds. The jogger described his assailant as a bird with a white underbelly and tail and a wingspread of 5 or 6 feet.

### Tecopa Pupfish Presumed Extinct

The Tecopa pupfish, a 1½-inch fish native to the Amargosa River near Death Valley in California, is being removed from the endangered species list — but not because it is no longer endangered. For the first time, the U.S. Fish and Wildlife Service is proposing removal of an animal because it is presumed extinct. Since 1970, FWS has been unable to find any trace of the fish which lived in the highly saline, warm water of the river. It apparently met its match with stream channelization, pollution, and introduction of nonnative, competing species, said FWS. "The most depressing thing about this loss of life form is that it was totally avoidable. The human projects which so disrupted its habitat, if carefully planned, could have ensured its survival," said Interior Assistant Secretary Robert L. Herbst.

Although not included on the endangered species list, another of the 12 subspecies of pupfish, the Shoshone pupfish of the same area, is also mentioned in the rulemaking as being extinct for the same reasons.



### Poaching Ring Broken Up

The gamey flavor of freshly killed wild animals was so irresistible to many Detroit residents that they created an outlet for one of the nation's largest organized commercial poaching rings, which illegally killed more than 100,000 ducks, geese, deer, squirrels, rabbits, fox, fish, and other animals in the last few years. The ring was broken up recently by federal and state wildlife law enforcement officers.

An intensive 15-month undercover investigation climaxed on January 20 when 25 special agents of the U.S. Fish and Wildlife Service and 125 Michigan conservation officers simultaneously arrested 53 people in the Detroit area for illegally killing, selling, buying, and marketing dozens of species of fish and game.

"The entire operation is one of the most extraordinary cooperative wildlife law enforcement efforts ever engaged in between a state and the federal government," observed a U.S. Fish and Wildlife Service official. "Thanks to the teamwork and cooperation between the two enforcement organizations, the largest and most highly organized market hunting ring uncovered in recent years has been destroyed."

The illegal commercialization involved nearly 300 deer, 1,700 squirrels, 4,400 ducks, over 11,000 rabbits, and thousands of pounds of walleye fish. The poachers also killed and sold badgers, raccoons, red fox, pheasants, partridge, and geese.

The existence of a poaching ring was first suspected in late 1975 when the Michigan Department of Natural Resources learned from tipsters that an organized group was supplying several Detroit retail markets with wild game. Federal law enforcement officers were called in a year later to investigate possible violations of two federal wildlife laws. The Migratory Bird Treaty Act makes it a federal offense to kill, possess, or transport protected migratory birds, while the Black Bass Act outlaws interstate transfer of illegally caught fish.

In the fall of 1977 and throughout the remainder of the investigation, four federal and two Michigan DNR undercover agents penetrated the organization. The agents posed as route men and customer suppliers and dealt frequently with ring members who routinely carried weapons. In their undercover capacity to obtain evidence, agents bought the carcasses of illegally killed game and fish more than 75 times.

As route men, the agents would pick up the slaughtered game from poachers in southern Michigan and deliver it to another member of the ring for further processing. Customer suppliers would then deliver the meat to various retail meat markets in Detroit. The prices paid by the customers for the wild game were often much higher than for the same domestically produced species which could be bought legally.

"We suspect market hunting rings exist in and around several other major U.S. cities," said an FWS official. "However, we hope that our success in dismantling this large operation and the publicity surrounding it will reveal to the thousands of American consumers just what they are doing to the nation's wildlife."

Some of the methods used to obtain game and fish illegally included deer shining (locating the animal with a powerful light and then shooting it); luring flocks of ducks to baited feeding areas for slaughter; and cutting down trees with chain saws to drive raccoons from their dens for easier capture.

U.S. Attorney James K. Robinson of the Eastern District of Michigan in Detroit said that those arrested under federal warrants may be charged with violations of the Black Bass Act and/or the Migratory Bird Treaty Act which carries both misdemeanor and felony penalties. Robinson said that the matter would be presented before a federal grand jury in the near future.

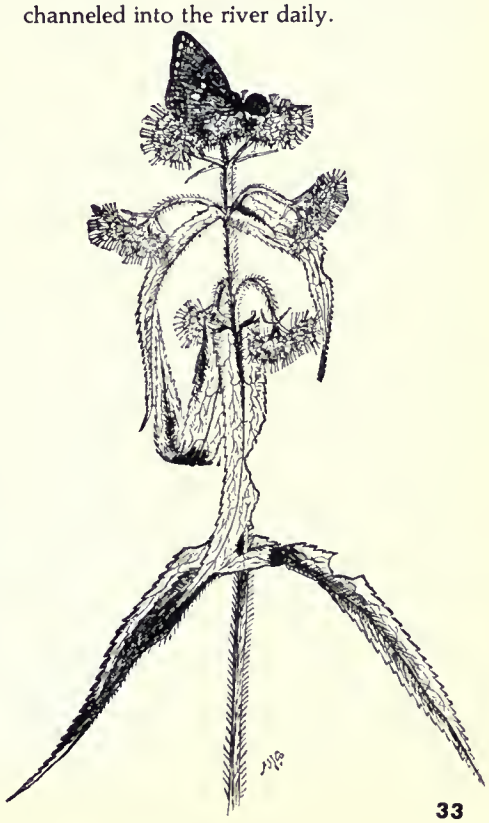
### Chemical Company President Convicted of Polluting Waterway

In a landmark environmental decision, a federal jury convicted the president of a Kentucky chemical firm of illegally dumping toxic chemicals into Louisville, Kentucky's, sewage system nearly two years ago.

The conviction marks the first time that an individual has been convicted of criminal charges for polluting a waterway.

It is also the first time that evidence obtained through a sophisticated chemical technique known as "oil spill profiling," or "fingerprinting," has been admitted into a federal court. The chemical test was done by a U.S. EPA lab and showed that samples taken from the Louisville sewer plant's entry chamber matched samples taken from a tank owned by the offending company.

The chemical dumping caused the shutdown of the wastewater treatment plant for Louisville and other parts of the surrounding county. During the three months the plant was closed, about 90 million gallons of raw sewage a day were dumped into the Ohio River. Two of the sewer's lines were still closed as of Dec. 27, causing from 7 million to 15 million gallons of sewage to be channeled into the river daily.



### Research on PCBs in River Systems

PCBs and Midwest weather have much in common. Both are cussed and discussed at great length, but there is not much that can be done with either.

PCBs (short for a family of chemicals known as polychlorinated biphenyls) are highly stable, nearly indestructible compounds formerly used in electrical transformers, hydraulic fluids, plastics, paints, and a host of other products. High temperature incineration (2700°F.) is the only approved method for their disposal.

Although they have been manufactured since the 1920s, an accidental discovery in 1966 found the contaminant to be widespread in the environment. The discovery caused a clamor among ecologists and health authorities in speculation about their effects in the food chain, especially in aquatic organisms where toxic levels of PCBs can be found.

Chronic exposure to PCBs can cause serious health effects to animals and man. In 1968, over 1,000 Japanese developed physical abnormalities when exposed accidentally to large doses of PCBs in rice oil. Their symptoms included severe acne, eye discharges, darkening of the skin, birth defects, and miscarriages. Very little is known, however, about the long-term effect of PCBs on human health.

PCBs characteristically accumulate in the body fat of animals—and man—and because of the stability of the chemicals organisms rid themselves of the contaminant at extremely slow rates.

The production for domestic use of PCBs was finally halted by the passage of the Toxic Substance Control Act of 1977. But the catch is, roughly one-half (250 million lbs.) of all PCBs ever manufactured are still in existence and much of it will be entering the environment for a long time.

Their entry into the environment through the "back door" via leakage from landfills, runoff, accidental spills, and other means has been a concern to the Interior Department's U.S. Fish and Wildlife Service (FWS). Agency researchers are attempting to better understand just what happens to PCBs entering the environment, particularly through our river systems.

Previous research has concentrated on freshwater bodies such as the Great Lakes, which act as a catch basin for the by-products of human society. The present FWS concern is what happens to PCBs and similar contaminants entering the environment through river systems. In addition, they are trying to see what happens to living organisms that come into contact with the contaminant. The strategy of the FWS is to concentrate its efforts on the Mississippi River and apply the knowledge to other similar rivers throughout the United States.

PCB levels in the Mississippi below Minneapolis and St. Paul are rather high, but at nowhere near the level at other locations. Lake Pepin, 80 miles down river from the Twin Cities, receives a rather stiff dose of contaminants, which tend to settle out in the lake. High water levels during the spring thaw carry much of the sediment and contaminant load to Lake Onalaska, 70 miles further down river at LaCrosse, Wisc., where research efforts are concentrated.

"There should be no cause for alarm or panic along the Mississippi concerning PCB levels," says an FWS spokesman. "They are there, but not in excessive quantities."

Various fish in the Great Lakes system contain PCB levels in excess of the "5 parts per million" health authorities have established as safe to eat. Certain fishes, namely carp, exceed this 5 ppm base in Lake Pepin. The commercial sale of this fish was banned in the lake, curtailing a local business.

FWS researchers are studying the bottom sediments, which range from clay and silt to sandy material. They hope to correlate bottom types and PCB levels with the living organisms found in this type of habitat. The research pays particular attention to fingernail clams and the mayfly, which act as indicator species because they are common, widespread, and act as carriers for contaminants found in bottom sediments. Fingernail clams and mayflies are fed upon heavily by other wildlife species. Fish are fond of mayflies and waterfowl, particularly scaup, dine on the tiny fingernail clam.

### Cage Birds Continue Popular

The cage-bird trade booms. Exports globally are around 7.5 million birds a year (1972 figures). Japan alone imports over one million. Of birds now in cages in U.S. homes, 80 percent started life in the wild in foreign lands. They are the "fortunate" ones; the survival rate between catcher and customer is around 20 percent.

Rare species are especially prized. Wild populations are declining alarmingly — at least nine have plunged into the endangered category. Some countries have introduced import controls but most have not.

### Future Carburetors May Be Nonadjustable

The EPA has announced changes in emission test procedures that could lead to nonadjustable carburetors in the early 1980s. The changes are being made because many car owners are adjusting their carburetors to improve performance, with a resulting increase in pollution.

Under existing rules, prototype vehicles must meet emission rules when carburetor and spark timing settings are as specified by the manufacturer. Under the new rules, which take effect with 1981 models, cars must pass such tests at whatever settings are physically possible.

As a result, auto companies will either have to produce nonadjustable carburetors and distributors or greatly reduce the adjustment range of these devices.

Auto industry reaction has been favorable, with estimates that the rule change will cost less than $10 per car. However, there have also been warnings that during the first 600 to 1,200 miles of engine operation, the cars may not run as smoothly as they might be expected to.

# March & April at Field Museum

(March 15 through April 15)

### New Exhibits

**Feather Arts: Beauty, Wealth, and Spirit from Five Continents.** Opened February 15. Conceived and created by Field Museum's own staff, this exhibit features exotic feather objects from around the world. Assembled almost entirely from in-house collections, "Feather Arts" will travel to other museums nationwide after its stay at Field Museum. The 260 artifacts, drawn from 1,000 years of history, include such rarities as an Hawaiian king's feather cape given to England's George IV in 1821, and the feather shoes of an Australian sorcerer. This fascinating exhibit examines the symbolic and religious meaning of feathers over the centuries and illustrates the importance of featherwork as a universal art form. Hall 26. Through June 15.

**A Stamp Sampler: Postage from Natural History.** Opened December 8. This exhibit unites 63 natural history specimens with samples of philatelic art. Projected to eventually cover the four disciplines of natural history, the exhibit for the first 8 months is devoted to the animal kingdom as illustrated on stamps from all over the world. "A Stamp Sampler" was conceived by Field Museum volunteer Col. M. E. Rada, exhibit guest curator. The exhibition was designed by Peter Ho, a University of Illinois graduate student.

### Continuing Exhibits

**Birds.** Exhibits in Halls 20 and 21 examine the varied worlds of birds, from the antarctic emperor penguin to the American sparrow. Three scenes are devoted to Chicago-area birds. Recently extinct birds and restorations of fossil birds are also on view.

**Man in His Environment.** Gain a worldwide perspective of environmental problems through the multi-media presentation of this thought-provoking exhibit. The center of the hall contains a recreated portion of a Georgia salt marsh encased in glass. The reconstruction allows visitors to study basic ecological principles visually, within a total marsh environment. Detailed reading rails surround the exhibit. Main floor.

**The Hall of Chinese Jades** contains beautiful jade art spanning over 6,000 years of Chinese history. An exhibit in the center of the hall illustrates ancient jade carving techniques. Hall 30, second floor.

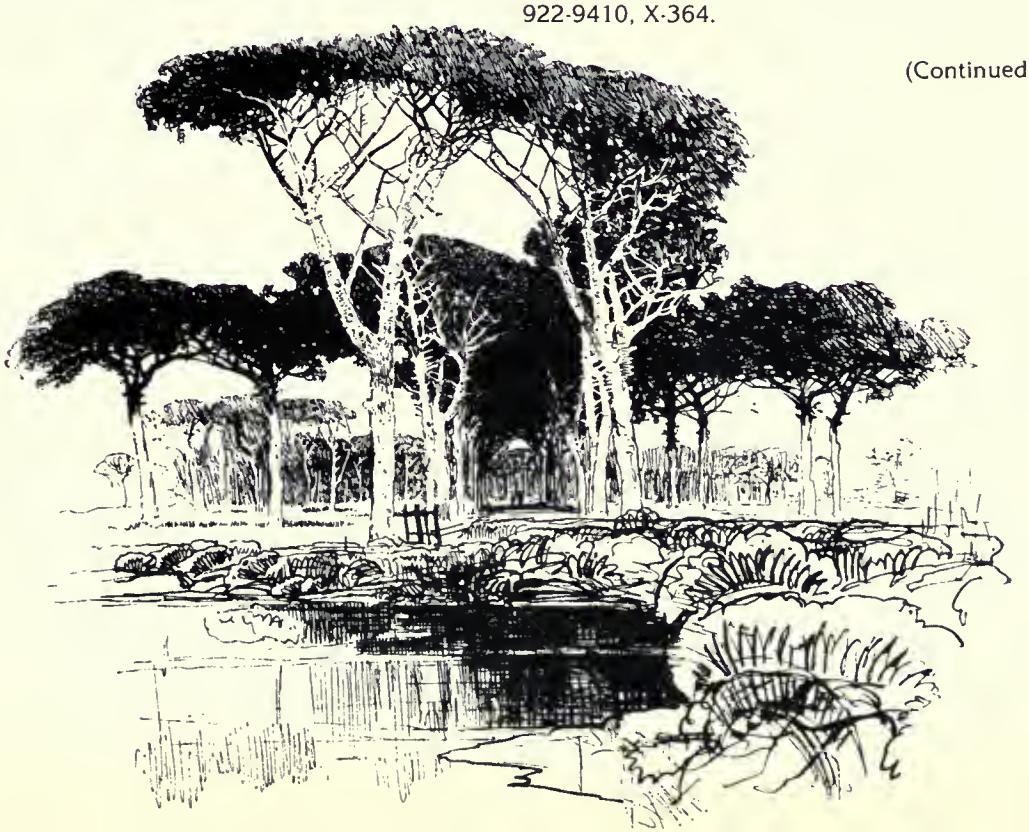
### New Programs

**Music from Around the World: Programs for Adults and Children.** In March and April, the Museum hosts a series of exotic musical programs from the Far East.

"Gamelan Mini-Concerts." Sunday, March 18 at 2 p.m. and 3 p.m. The Gamelan Master Class, under the direction of Dr. Sue Carole De Vale, offers free concerts on the Museum's 24-piece Javanese gamelan in Hall K. Ground floor.

"Music of the Orient" with Ira Kersh. Saturdays, March 24 and March 31. This two-part program introduces children to the Oriental cultures through musical instruments and performances. Part I: "Music of Asia." Enables children to use instruments from Tibet, China, India, Indonesia, and Asia. Part II: "Indonesian Wayang Shadow Puppets." Introduces children to the music and folklore of Java and Bali. Participants learn to use puppets and accompany the action on bamboo rattles; advance reservations required. Parents, also invited, should purchase tickets if planning to attend with their children. Members admission: $1.50; nonmembers: $3.00. Tickets: 922-9410, X-364.

(Continued on back cover)



# March and April at Field Museum

(Continued from inside cover)

"The Japanese Koto: A Program of Traditional and Contemporary Music." Sunday, March 25, 2 p.m. With Ricardo D. Trimillos, professor of music at the University of Hawaii. This concert, presented in traditional Japanese dress, offers 17th- and 18th-century classical compositions for the koto (a zitherlike instrument), followed by avante garde American and Japanese compositions. Admission: members, $5.00; nonmembers, $6.00. Pre-concert members' brunch available at 12 noon for $6.00. A post-concert reception, open to the public, will also be held. Admission: members, $4.50; nonmembers, $5.00. James Simpson Theatre. For tickets phone 922-9410, X-364.

"On Music in India" with Nazir Ali Jairazbhoy, professor of music at the University of California at Los Angeles. Sunday, April 1 at 2 p.m. This multimedia lecture/demonstration explains the fundamental concepts of Indian music, the role of music in the life of an Indian musician, and Indian musical styles. The sitar, a long-necked lute, will be played. Admission for members is $5.00; nonmembers, $6.00. A members' pre-concert brunch is available at 12 noon. Admission is $6.00. A post-concert reception, open to the public, will also be held. Admission: members, $4.50; nonmembers, $5.00. James Simpson Theatre. Tickets: 922-9410, X-364.

**Spring Journey.** "The Meaning of Feathers." Through May 31. Self-guided tour leads families and children through exhibits to discover what birds and their feathers mean to various cultures. Free *Journey* pamphlets are available at the North Information Booth, and at the South and West doors.

**The Edward E. Ayer Film Lectures** resume during March and April. These free, adult-oriented travel films begin each Saturday afternoon at 2:30 p.m. in Simpson Theatre. Reserved seating is available for Members and their families. Admission free at the West entrance. Doors open at 1:45 p.m. March 17: "Sweden—A Midsummer's Night Dream." March 24: "Germany—Once Upon a Time." March 31: "Egypt—Gift of the Nile." April 7: "China After Mao." April 14: "The Marsh—A Quiet Mystery."

### Continuing Programs

**Armchair Expeditions.** Geared for adults, these in-house "expeditions" include special slide lectures and tours of selected exhibits. Dining arrangements available. During March, the Museum features slide lectures on "Feather Arts" by Phyllis Rabineau, curator-in-charge of the exhibit. The following dates are available by reservation only: March 21 at 7:30 p.m., March 24 at 10 a.m. and 2 p.m., and March 28 at 7:30 p.m. Phone 922-0733 for more information.

**Friend or Foe? The Natural History Game.** Field Museum's popular "Anthropology Game" has been expanded to include botany, geology, and zoology. The object here is to determine which one of a pair of apparently similar specimens is harmful and which is not. See if you can distinguish a vampire bat, a headhunter's axe, a poisonous mineral, or a deadly mushroom from its benign look-alike. Ground floor, no closing date.

**On Your Own at Field Museum.** Self-guided tour booklets, adult- and family-oriented, are available for 25¢ each at the entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

**Volunteer Opportunities.** Limited opportunities are available in botany, geology, and zoology. Weekend volunteers with an interest in natural history are needed to develop and present weekend programs. For more information call 922-9410, X-360.

**March and April Hours.** The Museum is open every day, 9 a.m. to 5 p.m., except Fridays. On Fridays the Museum is open 9 a.m. to 9 p.m. throughout the year.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Closed Good Friday, April 13. Obtain a pass at the reception desk, main floor.

**Museum telephone:** (312) 922-9410.

April
1979

# FIELD MUSEUM OF NATURAL HISTORY BULLETIN

**Field Museum of Natural History Bulletin**

April, 1979
Vol. 50, No. 4

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## Field Museum of Natural History
Founded 1893

*President and Director:* **E. Leland Webber**

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*Spring ferns at Waterfall Glen, DuPage County. Photo by John Kolar.*

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# FIELD BRIEFS

### Field Trips for Adults and Families

With the long winter finally over, it's time at last to enjoy outdoor activities that don't involve snow. The Ray A. Kroc Environmental Education Program, resuming in May and June, features one-day trips to local areas of special biological and ecological interest. Groups are accompanied by Field Museum staff or guest scientists with expertise in botany, zoology, or geology. The current schedule includes trips to the Starved Rock area, Volo Bog, Gensburg-Markham Prairie, the Indiana Dunes, and areas especially abundant with spring wildflowers.

Both adult trips and family trips are available, but *early* registration (by mail) is strongly recommended.

Field Museum members are automatically mailed the field trip brochure with trip dates and registration form. Nonmembers may receive the brochure by calling 922-9410 ext 362, or by writing to: Department of Education—Field Trips, Field Muesum, Roosevelt Rd. at Lake Shore Drive, Chicago, Il. 60605.

*Environmental field trips are geared for family groups as well as for adults.*

**Borden Expedition Members Reunited.** *On Feb. 3 several members of the Borden-Field Museum Alaska Arctic Expedition of 1927 were reunited at Field Museum for a reception in their honor. Left to right: Bruce Andrews, of Ellenton, Fla.; Mrs. Foster Adams, of New York City; Rev. T. V. Purcell, of Washington D.C.; Dr. Courtney Cazden, of Stanford, Calif.; Kenneth McClelland, of Chicago; and Foster Adams, of New York. Andrews, Purcell, and McClelland were Sea Scout crew members of the expedition. Mrs. Adams, then Mrs. John Borden, was the wife of the expedition leader and a member of the expedition party. Dr. Cazden is the daughter of Mrs. Adams.*

*Following the reception in their honor, a film of the expedition was shown in James Simpson Theatre, introduced by Mrs. Adams and narrated by Rev. Purcell. The film will be shown at the Museum again in the near future, date to be announced.*

### Field Museum Selected as NEH Learning Museum

A three-year Learning Museum grant has been awarded Field Museum by the National Endowment for the Humanities, a federal agency. The purpose of the $300,495 grant is to provide public, adult education courses in the humanities. Field Museum's collections will provide the resource base and largely determine course content. Courses will involve multimedia instruction, performing arts presentations, cultural festivals, and lectures by distinguished specialists. "China, its History, Culture, and Art" is the Learning Museum theme for 1979, with course activities beginning in May. Details will be announced.

The Learning Museum program director is Susan Stob; program coordinator is Anthony Pfeiffer. For further information contact Learning Museum Program, Department of Education, Field Museum, 922-9410, X 395.

# Kimberley Snail Hunt Round V

BY ALAN SOLEM

Readers of the *Field Museum Bulletin* have often seen there articles about the thrills, traumas, adventures, and even misadventures during the course of a curator's field work. The accompanying photographs frequently show spectacular scenery; scruffy looking scientists in camp or hillside; and animals, plants, or cultural relicts being collected, prepared, measured, or photographed. Our first flush of nostalgic writing about field life can be read with fascination even years later. Often these articles are penned hurriedly while we are in the initial culture shock of re-entry to city and museum life after the simplicity and uninterruptedly focused efforts in the field. Fun to do, sometimes dramatic, and a standard duty for the returned scientist, such *Bulletin* fare will continue.

It is far more difficult, totally undramatic, much more fragmented, and quite unusual for us to try to write about the aftermath—the long period of specimen processing, data-taking and manipulation, idea-organizing, describing, writing, synthesizing, illustrating, publishing, and the lecturing to scientific groups that normally follow from major field programs. We are subject to the everyday interruptions and multiple duties of working for a complex organization, plus the varied and complicated demands of living in a large city. Inevitably, the progress of such work must be fragmented and sporadic. The project may have to be put aside for weeks, or even months, while pressing deadlines and accumulated problems are met. Rarely is it possible to produce the research quickly or even to have a coherent follow-up story for presentation two years after a major collecting effort.

My last field station in Australia was in the Olgas, barren red rocks near Ayers Rock in Central Australia, on May 27, 1977. After the incredible heat and humidity of the Kimberley (see March, October, November, 1977 *Bulletin*), the last camp-out, a few days and a thousand miles south, was memorable, since windshield, tent, and gear were frost-covered by dawn. A night spent in Mt. Gambier with friends, then drive through a storm that deposited a full half-inch of snow on the highway near Melbourne. The next morning, Melbourne papers heralded that record low temperatures for May (33° fahrenheit) had resulted in a total lack of reported crime in that city of 2 million people. Frantic packing of specimens and gear preceded flying back to the United States.

Then began the long wait for the specimens to come. It took three months for the crates to go from Perth and Melbourne to New York; two months from New York to Chicago; and one month from a Chicago freight terminal to the Museum—a sad commentary on modern transportation efficiency. This delay did permit my partly catching up on letters and reports. At long last the by-now slightly battered green shipping cases, still with their coating of red Australian dust, lay on my office floor. Immediately, 150 pint, half-pint, half-liter, and liter jars filled with specimens had to have their alcohol changed, since body fluids from the thousands of preserved snails had drastically diluted the original 95% alcohol level.

Snails had been collected at some 300 different stations. Often the same station had been visited on several different dates, over a period of months. Could I remember exactly what had been collected where? Of course not. Since most were unknown species and genera, this is not surprising. Most of my time in the next two months was spent in sorting and organizing these specimens for study. Why my time? Why not an assistant? For several reasons. First, I didn't have an assistant available for such work. Second, this was an invaluable chance for me to take an overall look at what I had collected. Two-thirds of the species had never been found before, and many that lived in

Alan Solem is curator of invertebrates. His "Kimberley Snail Hunt—Round I" and "Kimberley Snail Hunt—Rounds II through IV" appeared in the March and October, 1977, *Bulletins*, respectively.

# What Happened When

different ways at the same station looked superficially very much alike to the untutored eye. At the same time that I was doing "routine sorting and processing," I was trying to evaluate subjectively the patterns of variation and make tentative guesses as to what order of study might make the most sense. Besides, actually handling *specimens* can be and remains a pleasant break from the accumulated mass of letters from twelve-month absence, plus, asked-for reports and memos. Most important, detailed study and writing could not commence until sorting of the field collections had been completed.

From October 1977 through January 1978, preliminary sorting, labeling, and cataloguing of the specimens continued. From my 1976-77 Australian field work, 1,843 lots and 42,000 specimens were processed. This was added to the 798 lots and 22,000 specimens collected in 1974. About two-thirds of these were camaenid land snails, the group I was mainly interested in. Now the work of detailed study and publishing could begin.

The cold and snow of winter, 1978, was a marked physical contrast to the summer heat and blue skies in Perth the previous year. For illustrator Elizabeth Liebman, work was much the same. I dissected, she illustrated the anatomy of species belonging to several genera that are common in or restricted to the Kimberley region. We had made a major start on this material January through April, 1977, in Perth, based upon specimens I had collected from September through December, 1976. Many more specimens had been gathered by Laurie Price, Carl Christiansen, and myself in January through May, 1977. None of them had been studied yet. These specimens all had to be measured, checked for reproductive stage, and analyzed for similarity or structural differences from populations sampled in neighboring ranges. The whole package of information about each species then had to be organized for comparisons with related taxa.

All of the above tasks were my responsibility. Snatching research work from interruptions

proved, at times, to be extremely difficult. I have between 135 and 150 species of Western Australian camaenids, only 40 of which had been named previously, and their interrelations are unknown. Which species should I study and write up first? Should I try to publish one massive monograph? A series of shorter reports? Where should I start?

Dissections made in 1975 and 1976 on the materials collected in 1974 had "sampled" the anatomy of the Pilbara, Central Australia, and southwestern Western Australian taxa. My late 1976 collections from the Kimberley had been similarly "sampled" by dissections in Perth. Comparing the many drawings and dissections showed that the Southern, Pilbara, and Central Australian species had many features in common, but that the center of diversity was in the Kimberley. The snails there showed many variations. This made it necessary to start the major revisionary work with the Kimberley fauna. Did those species from the other areas have relatives in the Kimberley, or were they very different? Only study of the Kimberley camaenids could determine this, so thorough study of the many Kimberley camaenids became the first order of business. But this area had almost a hundred species. Where should I start with this mass of material? Preliminary dissections had confirmed that several species were related to those from the Pilbara (these could wait until last), others seemed to have no relatives elsewhere (second priority), while a comparative few looked very much like species described from Eastern Australia (first priority).

Materials borrowed from museums in Sydney, Melbourne, and Perth provided comparative anatomical material, and specimens collected for Field Museum in the 1960s and 1970s by Field Associate Laurie Price of New Zealand proved invaluable. Since no anatomical work on Australian members of this family had been published in this century, every dissection was important. We found four groups of Western Australian species that had close relatives in Eastern States. But to define these groups properly, 20 other Eastern Australian genera had to be dissected and 10 illustrated immediately; 4 closely related species had to be dissected and illustrated; and finally the 14 Western Australian species in these four groups reviewed. A few other probably related species could not be dissected, but were reviewed as to shell variations. So a first project of reviewing these "Trans-Australian" taxa evolved into a logical package, with a total of 29 species, 7 new to science, belonging to 10 genera, one new to science. Thus the *dimensions* of the first publication came into focus.

What information should be published about each species? Some things are basic. Illustrations to enable identification of the shells, words summarizing how the species differs in shell and anatomy from closely related species, data on the anatomical structures that vary within the genus or among closely related genera, a list of localities from which it has been collected, a summary of the range in size, shape, color, and sculpture variation condensed into a formal description —all these are basic data in a systematic revision of a little known or previously unknown group of snails. But I was asking additional questions in my research. What are the overall geographic patterns of variations, *i.e.*, are members of the same species bigger (smaller) in the West Kimberley than the East Kimberley; are species commoner (rarer) than other taxa in the same (different) areas? What is the reproductive cycle in the camaenids from different parts of Australia? Are they reproductively active at the same time, different times, over a short season, throughout the year, different times in different areas? Do they have special feeding habits when several species live together? How do species recognize members of the same species when ready to mate? Do parts of the anatomy vary seasonally in size and shape? Where do the snails shelter and what strategy do they use to survive periods of drought?

Besides, research papers are designed as much to focus on problems and pose currently unanswerable questions, as to provide answers. By providing data on local shell variation (or lack of it), seasonal variations in anatomical structures, species recognition mechanisms, where available, and the attention of Australian workers could be called to areas where data was inadequate.

So these decisions led to the basic *content* of the report. Since it was to be published in the *Records of the Western Australian Museum*, Perth, Australia, the *format* of the report had to follow their style. With dimensions, content, and format decided, "all" that remained was to produce the report.

Up to this point, most of the work had been done by scientist and illustrator. Specimen-processing had involved label typing by Sharon Bacoyanis, then cataloguing by Andy Cawthon and CETA (Combined Employment Training Act) workers, but the dissecting, measuring, sorting, and grouping into species had been done by Alan Solem. Elizabeth Liebman had prepared 70 separate anatomical drawings, varying in complexity from simple outlines to highly detailed full page illustrations, and 42 outline drawings showing shell structure. Photographs of shells made in Perth, and scanning electron microscope pictures of shell sculpture details were organized into 11 plates, while the shell and anatomy drawings, in consultation between Solem and Liebman, were sorted into groups and laid out as 35 text figures. Associate Dorothy Karall, as she has so skillfully for many years, mounted and labeled the plates and text figures for reproduction. The latter then were photographed, both to retain a working copy here in Chicago, and as security when the originals, representing at least six months of work by Elizabeth Liebman, were sent to Perth for publication.

Meanwhile, I sat at microscope and type-

writer for days and many nights composing page after page of manuscript. When the write-up of each genus was finished in rough form, I then lightly (if composed on a good day or evening) to very heavily (if composed on a bad day or during a period of constant phone or visitor interruptions) edited the rough manuscript in preparation for typing. Therein lay a problem. My highly efficient secretary for the past three years moved to California with her husband, .and it was nearly two months before Valerie Connor-Jackson was hired to take her place. Valerie was uniquely qualified after working through a 4,000-page manuscript on monkeys*, and her experience as a department secretary in botany enabled her to immediately take over office routine and produce the final manuscript. So on March 9, 1978, the first of several reports, 211 typed pages, 35 text figures, 11 plates, and 10 tables, was mailed to Perth for publication. Proof is expected this summer, and publication is scheduled for September, 1979. The team of Solem, Liebman, Karall, and Connor-Jackson then swung into high gear, and progress on Part II, dealing with another 28 species from the Kimberley, all belonging to one genus, was rapid. Assists from volunteer Kleinie Fieberg; CETA employees Loretta Brown, Joseph Strotter, and Jarmaine Leftridge; new Custodian of Collections, Margaret Baker, in preparing lists of the material studied and analysis of measurements, were essential.

This time, three plates of photographs, 79 drawings of shells and 102 anatomical illustrations, plus a map organized into 38 text figures, and 23 tables accompanied 281 typed pages of manuscript to Perth on September 15, 1978. This was the second "package," and months before it was finished, certain facts were obvious. I was suffering from an embarrassment of riches. The field work had been successful well beyond expectations, and the material obtained was far more diverse in number of species and extensive in terms of number of specimens than had been anticipated. It would not be possible to complete study or illustration of all the species within the period for which I had grant funding. Available funds would carry Illustrator Elizabeth Liebman through October, 1978, but that was the end.

It was obvious that, when I had finished the basic systematic review, interesting answers would come to many of my general questions, and a whole host of new research questions, would be raised. But until the systematic revisions were completed, publication on these would be inadvisable to impossible. Additional funding had to be sought, first to complete the systematic reviews, then to extract the general interest conclusions, and hopefully to build upon this foundation of work by extending the survey of camaenid snails to other regions. So illustrator and scientist worked frantically to complete dissection, measurements and illustrations of materials for Part III, review of a remarkable fauna from the Ningbing Ranges, by October 30.

In a flurry of activity, this was successful, and the problem of the next stage of study could be faced. But that is another part of the continuing story, and for the future. Here you have a glance at a complex publishing project in mid-stream, a pay-off from the planning, sweat in the field, and infinitely longer hours of museum work that followed.

So, the next time you read of an expedition, think of what must follow. . . .

*Philip Hershkovitz's* Living New World Monkeys (Platyrrhini), with an introduction to Primates. *Vol. 1. (1,117 printed pages, figures, plates, tables, maps.)*

# THE SOVIET UNION

*Bolshoi Theatre, Moscow*

THE SPLENDORS OF OLD RUSSIA, the excitement of the New are in store for Field Museum Members and their families who join the tour "Treasures of Russia and the Ukraine," leaving Chicago's O'Hare Airport June 19 and returning July 8.

Highlights of the exclusive tour will include visits to the cities of Moscow, Vladimir, Kiev, Leningrad, Petrovorets, Novgorod, and Petrozavodsk. The group, limited to 35 persons, will be led from Chicago by a Russian-speaking lecturer and a Russian-speaking escort, with additional guides while in the Soviet Union provided by *Intourist* (the Soviet Travel Bureau).

The tour cost—$2.970 (which includes a $500.00 donation to Field Museum)—is based upon double occupancy and includes round trip air fare from Chicago to Moscow, with intra-Russian air transportation where required. The transatlantic airline is Swissair.

Deluxe hotel accommodations will be used throughout or, where necessary, the best hotels available. The package includes all meals, including inflight meals; all sightseeing via deluxe motor coach; all admissions to special events and sites, where required; all baggage handling throughout, plus all necessary transfers; all applicable taxes and tips; all applicable visa fees. Advance deposit required: $250.00 per person.

For full itinerary, additional details, and registration information for all tours, please write or call Michael J. Flynn, Field Museum Tours, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.

# *Red Square and Beyond*

Stand in the middle of Red Square in Moscow and slowly turn in a full circle. To the south you see before you the bizarre cathedral that Ivan the Terrible had erected in thanksgiving for his victory over the Tartars of Kazan, dedicated to the protection of the Virgin and St. Basil the Blessed. You are back in the mid-16th century when Russia was just emerging as one of the great powers of Europe. As you turn to the right you are soon looking at the Kremlin Wall, pierced by the Spassky Gate that predates Ivan's cathedral by 100 years, though the walls, originally of oak, were first thrown up as a rampart 300 years before that.

Through the opening of the Spassky Gate and peeking over the walls you see the towers of the great churches, the Ivan Belltower, as well as the palaces old and new in which so much of Russia from the Tsars to the Soviets flowed. Continue your pivot and before you is the cubist granite tomb of Lenin and you are back in our violent century, recalling the worldwide tumult and upheaval caused by that man on whose embalmed figure you can gaze by joining the crowd and silently entering that mausoleum.

Further on at the far end of the square you see an odd building in red brick that clashes with the other decor of the square, the Historical Museum, built a century ago on the Russo-Victorian design of an Englishman. Turn your back to the Kremlin and you are looking at GUM, the State Department Store, the largest in the Soviet Union. It is not a flashy modernistic building, but an old-fashioned series of shops arranged along an open arcade that runs the whole great length of the building and several floors high. Thus, when one gets tired of sightseeing, the recreation of shopping is right at hand, or repose, symbolized by the Stalinesque hotel that rises beyond GUM, the newest addition to tourist comforts in the capital.

With a final spin you have St. Basil's in the background once more. You may now notice that before the entrance to the cathedral there is a heroic statuary group dedicated to the popular heroes, Minin and Pozharsky, of the struggle against the Poles following the Troubled Times after Ivan the Terrible's death and Boris Godunov's usurpation, when Moscow and western Russia were overrun by foreign legions.

If one could lengthen his range of vision on each gyration in the square, he would see the far reaches of Moscow with its remnants of the old in churches and monasteries and its new Soviet institutions, the university, the great stadia, the Exhibition of Culture and Progress, out of the Moscow River that wanders in and out of the city and curves around most of it.

Then in a longer stretch of vision we could look back into the past of Russia in its ancient cities surrounding Moscow—Vladimir, Suzdal, Tver, that were rivals of budding Moscow when the Tartar invasions overran the country in the thirteenth century and dealt a crippling blow to old Kiev. Kiev with Novgorod in a further projection was the center of civilization that received the Viking invaders from the North and formed the River Road for trade with Constantinople. Both cities were cradles of Old Rus', the original state founded by the invading Norsemen. Kiev is now a great modern city with its ancient treasures overshadowed by modern construction and the rush of commerce, whereas Novgorod has not grown back to modern greatness but shines forth in its great Kremlin with the sister church of Kiev's Cathedral of the Holy Wisdom that date back to the twelfth century. A visit to these cities is a look back into the very origins of Rus'. In the Kremlin of Novgorod stands proudly with the blessing of the Soviet government the beautiful bronze memorial, erected during the last century in commemoration of the thousandth anniversary of the christianization of Rus', even as St. Vladimir in bronze holds up a colossal cross high above the Dnieper River at Kiev where the baptism of the peoples took place.

Four hundred miles from Moscow and centuries removed in spirit is the city that Peter built to be a window on the West. For two centuries it was St. Petersburg, then when wartime enmities made the German-sounding name unwelcome, it became briefly Petrograd, only to end up as Leningrad. Peter had made it his capital, and all the tsars and their families lie entombed in the chapel of the Fortress of Sts. Peter and Paul from Peter to Alexander III. Though it is no longer the capital, it is certainly a most interesting and unique city to visit. Peter's spirit and Catherine's energy still reflect from its gracious palaces and churches. The world-famous museum, the Hermitage, is here, as is Russia's greatest church, St. Isaac's, with Kazan Cathedral a ways up Nevsky Prospect a close second. No palace is more intriguing, especially in its gardens, then Petrodvorets, once Peterhof, the Russian Versailles. The miracle of Leningrad is that it was mostly rubble just thirty odd years ago after the merciless pounding the Germans gave it during a siege of almost a thousand days.

So the Soviet Union is not just an industrial colossus, not a testing ground for communist change, not a military monster straining to break loose and spew death on all the world. It is the inheritor of a great civilization that grew up on the steppes and in the forests of Eastern Europe and produced some of the greatest regal, eccleastical, political monuments in the world together with some of the greatest music and literature—a country well worth visiting and studying to catch some of its mystique and come to an understanding of its physical and spiritual power. Here is a giant that sprawls a quarter of the way around the globe, holding aloft the star of the North that casts long shadows on East and West.—*Rev. Maurice J. Meyers, S. J., guest lecturer, Soviet Union Tour*

*Cathedral of St. Basil, Moscow*

# BUTTERFLIES

*BY* VLADIMIR NABOKOV

I

On a summer morning, in the legendary Russia of my boyhood, my first glance upon awakening was for the chink between the shutters. If it disclosed a watery pallor, one had better not open the shutters at all, and so be spared the sight of a sullen day sitting for its picture in a puddle. How resentfully one would deduce, from a line of dull light, the leaden sky, the sodden sand, the gruel-like mess of broken brown blossoms under the lilacs—and that flat, fallow leaf (the first casualty of the season) pasted upon a wet garden bench!

But if the chink was a long glint of dewy brilliancy, then I made haste to have the window yield its treasure. With one blow, the room would be cleft into light and shade. The foliage of birches moving in the sun had the translucent green tone of grapes, and in contrast to this there was the dark velvet of fir trees against a blue of extraordinary intensity, the like of which I rediscovered only many years later, in the montane zone of Colorado.

From the age of six, everything I felt in connection with a rectangle of framed sunlight was dominated by a single passion. If my first glance of the morning was for the sun, my first thought was for the butterflies it would engender. The original event had been banal enough. On some honeysuckle near the veranda, I had happened to see a Swallowtail—a splendid, pale-yellow creature with black blotches and blue crenulations, and a cinnabar eyespot above each chrome-rimmed black tail. As it probed the inclined flower from which it hung, it kept restlessly jerking its great wings, and my desire for it was overwhelming. An agile footman caught it in my cap, after which it was transferred, cap and all, to a wardrobe, where the reek of napthalene was fondly expected to kill it overnight. On the following morning, however, when my governess unlocked the wardrobe to take something out, the butterfly, with a mighty rustle, flew into her face, then made for the open window, and presently was but a golden fleck dipping and dodging and soaring eastward, over timber and tundra, to Vologda, Viatka and Perm, and beyond the gaunt Ural range to Yakutsk and Verkhne Kolymsk, and from Verkhne Kolymsk, where it lost a tail, to the fair Island of St. Lawrence, and across Alaska to Dawson, and southward along the Rocky Mountains—to be finally overtaken and captured, after a forty-year race, on a bright-yellow dandelion in a bright-green glade above Boulder.

Soon after the wardrobe affair I found a spectacular moth, and my mother dispatched it with ether. In later years, I used many killing agents, but the least contact with the initial stuff would always cause the door of the past to fly open; once, as a grown man, I was under ether during an operation, and with the vividness of a decalcomania picture I saw my own self in a sailor suit mounting a freshly emerged Emperor moth under the guidance of my smiling mother. It was all there, brilliantly reproduced in my dream, while my own vitals were being exposed: the soaking, ice-cold absorbent cotton presed to the lemurian head of the moth; the subsiding spasms of its body; the satisfying crackle produced by the pin penetrating the hard crust of its thorax; the careful insertion of the point of the pin in the cork-bottomed groove of the spreading board; the symmetrical adjustment of the strong-veined, "windowed" wings under neatly affixed strips of semi-transparent paper.

II

I must have been eight or nine when, in a storeroom of our country house, among a medley of dusty objects, I discovered some wonderful books acquired in the days when my mother's mother

First published in *The New Yorker Magazine*, June 1948.

had been interested in natural science and had had a famous university professor of zoology (Shimkevich) give private lessons to her daughter. Some of these books were mere curios, such as the four huge brown folios of Albertus Seba's work (*Locupletissimi Rerum Naturalium Thesauri Accurata Descriptio . . .*), printed in Amsterdam around 1750. On their coarse-grained pages I found woodcuts of serpents and butterflies and embryos. The foetus of an Ethiopian female child hanging by the neck in a glass jar, used to give me a nasty shock every time I came across it; nor did I much care for the stuffed hydra on plate CII, with its seven lion-toothed turtleheads on seven serpentine necks and its strange, bloated body which bore button-like tubercles along the sides and ended in a knotted tail.

Other books I found in that attic, among herbariums full of edelweiss flowers and crimson maple leaves, came closer to my subject. I took in my arms and carried downstairs glorious loads of fantastically attractive volumes: Maria Sibylla Merian's (1647-1717) lovely plates of Surinam insects, and Esper's noble *Die Schmetterlinge* (Erlangen, 1777), and Boisduval's *Icones Historiques de Lépidoptères Nouveaux ou Peu Connus* (Paris, begun in 1832). Still more exciting were the products of the latter half of the century—Newman's *Natural History of British Butterflies and Moths*, Hofmann's *Die Gross-Schmetterlinge Europas*, the Grand Duke Nikolai Mikhailovich's *Mémoires* on Asiatic lepidoptera (with incomparably beautiful figures painted by Kavrigin, Rybakov, Lang), Scudder's stupendous work on the *Butterflies of New England*.

By my early teens, I was voraciously reading entomological periodicals, especially English and Russian ones. Great upheavals were taking place in the development of systematics. Since the middle of the century, Continental lepidopterology had been, on the whole, a simple and stable affair, smoothly run by the Germans. Its high priest, Dr. Staudinger, was also the head of the largest firm of insect dealers. Even now, half a century after his death, German lepidopterists have not quite managed to shake off the hypnotic spell occasioned by his authority. He was still alive when his school began to lose ground as a scientific force in the world. While he and his followers stuck to specific and generic names sanctioned by long usage and were content to classify butterflies by characters visible to the naked eye, English-speaking authors were introducing nomenclatorial changes as a result of a strict application of the law of priority and taxonomic changes based on the microscopic study of organs. The Germans did their best to ignore the new trends and continued to cherish the philately-like side of entomology. Their solicitude for the "average collector who should not be made to dissect" is comparable to the way nervous publishers pamper the "average reader" who should not be made to think.

There was another more general change, which coincided with my ardent adolescent interest in butterflies and moths. The Victorian and Staudingerian kind of species, hermetic and homogeneous, with sundry (alpine, polar, insular, etc.) "varieties" affixed to it from the outside, as it were, like incidental appendages, was replaced by a new, multiform and fluid kind of species, made up of geographical races or subspecies. The evolutional aspects of the case were thus brought out more clearly, by means of more flexible means of classification, and further links between butterflies and the central problems of nature were provided by biological investigations.

The mysteries of mimicry had a special attraction for me. Its phenomena showed an artistic perfection usually associated with man-wrought things. Such was the imitation of oozing poison by bubble-like macules on a wing (complete with pseudo-refraction) or by glossy yellow knobs on a chrysalis ("Don't eat me—I have already been squashed, sampled and rejected"). When a certain moth resembled a certain wasp in shape and colour, it also walked and moved its antennae in a waspish, un-mothlike manner. When a butterfly had to look like a leaf, not only were all the details of a leaf beautifully rendered but markings mimicking grub-bored holes were generously thrown in. "Natural selection," in the Darwinian sense, could not explain the miraculous coincidence of imitative aspect and imitative behaviour nor could one appeal to the theory of "the struggle for life" when a protective device was carried to a point of mimetic subtlety, exuberance, and luxury far in excess of a predator's power of appreciation. I discovered in nature the non-utilitarian delights that I sought in art. Both were a form of magic, both were a game of intricate enchantment and deception.

## III

Few things indeed have I known in the way of emotion or appetite, ambition or achievement, that could surpass in richness and strength the excitement of entomological exploration. From the very first it had a great many inter-twinkling facets. One of them was the acute desire to be alone, since any companion, no matter how quiet, interfered with the concentrated enjoyment of my

mania. Its gratification admitted of no compromise or exception. Already, when I was ten, tutors and governesses knew that the morning was mine and cautiously kept away.

In this connection I remember the visit of a schoolmate, a boy of whom I was very fond and with whom I had excellent fun. He arrived one summer night from a town some fifty miles away. His father had recently perished in an accident, the family was ruined and the stouthearted lad, not being able to afford the price of a railway ticket, had bicycled all those miles to spend a few days with me.

On the morning following his arrival, I did everything I could to get out of the house for my morning hike without his knowing where I had gone. Breakfastless, with hysterical haste, I gathered my net, pillboxes, sailor cap, and escaped through the window. Once in the forest, I was safe; but still I walked on, my calves quaking, my eyes full of scalding tears, the whole of me twitching with shame and self-disgust, as I visualised my poor friend, with his long pale face and black tie, moping in the hot garden—patting the panting dogs for want of something better to do, and trying hard to justify my absence to himself.

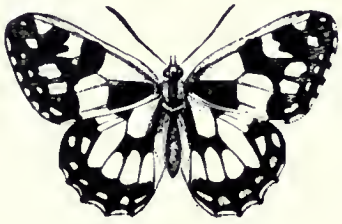
Let me look at my demon objectively. With the exception of my parents, no one really understood my obsession, and it was many years before I met a fellow-sufferer. One of the first things I learned was not to depend on others for the growth of my collection. Aunts, however, kept making me ridiculous presents—such as Denton mounts of resplendent but really quite ordinary insects. Our country doctor, with whom I had left the pupae of a rare moth when I went on a journey abroad, wrote me that everything had hatched finely; but in reality a mouse had got at the precious pupae, and upon my return the deceitful old man produced some common Tortoise-shell butterflies, which, I presume, he had hurriedly caught in his garden and popped into the breeding cage as plausible substitutes (so *he* thought). Better than he was an enthusiastic kitchen boy who would sometimes borrow my equipment and come back two hours later in triumph with a bagful of seething invertebrate life and several additional items. Loosening the mouth of the net which he had tied up with a string, he would pour out his cornucopian spoil—a mass of grasshoppers, some sand, the two parts of a mushroom he had thriftily plucked on the way home, more grasshoppers, more sand, and one battered Cabbage butterfly.

I also found out very soon that an entomologist indulging in his quiet quest was apt to provoke strange reactions in other creatures. How often, when a picnic had been arranged, and I would be self-consciously trying to get my humble implements unnoticed into the tar-smelling charabanc (a tar preparation was used to keep flies away from the horses) or the tea-smelling Opel convertible (benzine forty years ago smelled that way), some cousin or aunt of mine would remark: "Must you *really* take that net with you? Can't you enjoy yourself like a normal boy? Don't you think you are spoiling everybody's pleasure?" Near a sign NACH BODENLAUBE, at Bad Kissingen, Bavaria, just as I was about to join for a long walk my father and majestic old Muromtsev (who, four years before, in 1906, had been President of the first Russian Parliament), the latter turned his marble head toward me, a vulnerable boy of eleven, and said with his famous solemnity: "Come with us by all means, but do not chase butterflies, child. It mars the rhythm of the walk." On a path above the Black Sea, in the Crimea, among shrubs in waxy bloom, in March, 1918, a bow-legged Bolshevik sentry attempted to arrest me for signalling (with my net, he said) to a British warship. In the summer of 1929, every time I walked through a village in the Eastern Pyrenees, which I was exploring lepidopterologically, and happened to look back, I would see in my wake the villagers frozen in the various attitudes my passage had caught them in, as if I were Sodom and they Lot's wife. A decade later, in the Maritime Alps, I once noticed the grass undulate in a serpentine way behind me because a fat rural policeman was wriggling after me on his belly to find out if I were not trapping song birds. America has shown even more of this morbid interest in my doings than other countries have—perhaps because I was in my forties when I came here to live, and the older the man, the queerer he looks with a butterfly net in his hand. Stern farmers have drawn my attention to NO FISHING signs; from cars passing me on the highway have come wild howls of derision; sleepy dogs, though unmindful of the worst bum, have perked up and come at me, snarling; tiny tots have pointed me out to their puzzled mammas; broadminded vacationists have asked me whether I was catching bugs for bait; and one morning on a wasteland, lit by tall yuccas in bloom, near Santa Fé, a big, black mare followed me for more than a mile.

## IV

When, having shaken off all pursuers, I took the rough, red road that ran from our house toward field and forest, the animation and lustre of the day seemed like a tremor of sympathy around me.

Black *Erebia* butterflies ("Ringlets" as the old English Aurelians used to call them), with a special gentle awkwardness peculiar to their kind, danced among the firs. From a flower head two male Coppers rose to a tremendous height, fighting all the way up—and then, after a while came the downward flash of one of them returning to his thistle. These were familiar insects, but at any moment something better might cause me to stop with a quick intake of breath. I remember one day when I warily brought my net closer and closer to a little *Thecla* that had daintily settled on a sprig. I could clearly see the white *W* on its chocolate-brown underside. Its wings were closed and the inferior ones were rubbing against each other in a curious circular motion—possibly producing some small, blithe crepitation pitched too high for a human ear to catch. I had long wanted that particular species, and, when near enough, I struck. You have heard champion tennis players moan after muffing an easy shot. You have seen stunned golfers smile horrible, helpless smiles. But that day nobody saw me shake out a piece of twig from an otherwise empty net and stare at a hole in the tarlatan.



V

However, if the morning hunt had been a failure, one could still look forward to mothing. Colors would die a long death on June evenings. The lilac shrubs in full bloom before which I stood, net in hand, displayed clusters of a fluffy grey in the dusk—the ghost of purple. A moist young moon hung above the mist of a neighbouring meadow. In many a garden have I stood thus in later years —in Athens, Antibes, Atlanta—but never have I waited with such a keen desire as before those darkening lilacs. And suddenly it would come, the low buzz passing from flower to flower, the vibrational halo around the streamlined body of an olive and pink Small Elephant Hawk-Moth poised in the air above the corolla into which it had dipped its long tongue. Its handsome black larva (resembling a diminutive cobra when it puffed out its ocellated front segments) could be found on dank willow-herb two months later. Thus every hour and season had its delights. And, finally, on cold, or even frosty, autumn nights, one could sugar for moths by painting tree trunks with a mixture of molasses, beer, and rum. Through the gusty blackness, one's lantern would illumine the stickily glistening furrows of the bark and two or three large moths upon it imbibing the sweets, their nervous wings half open butterfly fashion, the lower ones exhibiting their incredible crimson silk from beneath the lichen-grey primaries. *"Catocala adultera!"* I would triumphantly shriek in the direction of the lighted windows of the house as I stumbled home to show my captures to my father.

VI

The "English" park that separated our house from the hayfield was an extensive and elaborate affair with labyrinthine paths, Turgenevian benches, and imported oaks among the endemic firs and birches. The struggle that had gone on since my grandfather's time to keep the park from reverting to the wild state always fell short of complete success. No gardener could cope with the hillocks of frizzly black earth that the pink hands of moles kept heaping on the tidy sand of the main walk. Weeds and fungi, and ridgelike tree roots crossed and re-crossed the sun-flecked trails. Bears had been eliminated in the eighties (two such stuffed giants stood on their hind legs in our entrance hall), but an occasional moose still visited the grounds. On a picturesque boulder, a little mountain ash and a still smaller aspen had climbed, holding hands. like two clumsy, shy children. Other, more elusive trespassers—lost picnickers or merry villagers—would drive our hoary gamekeeper Ivan crazy by scrawling ribald words on the benches and gates. The disintegrating process continues still, in a different sense, for when, nowadays, I attempt to follow in memory the winding paths from one given point to another, I notice with alarm that there are many gaps, due to oblivion or ignorance, akin to the terra-incognita

blanks map-makers of old used to call "sleeping beauties."

Beyond the park, there were fields, with a continuous shimmer of butterfly wings over a shimmer of flowers—daisies, bluebells, scabious, and others—which now rapidly pass by me in a kind of coloured haze like those lovely, lush meadows, never to be explored, that one sees from the diner on a transcontinental journey. At the end of this grassy wonderland, the forest rose like a wall. There I roamed, scanning the tree trunks (the enchanted, the silent part of a tree) for certain tiny moths, called Pugs in England—delicate little creatures that cling in the daytime to speckled surfaces, with which their flat wings and turned-up abdomens blend. There, at the bottom of that sea of sunshot greenery, I slowly spun around the great boles. Nothing in the world would have seemed sweeter to me than to be able to add, by a stroke of luck, some remarkable new species to the long list of Pugs already named by others. And my pied imagination, ostensibly, and almost grotesquely, grovelling to my desire (but all the time, in ghostly conspiracies behind the scenes, coolly planning the most distant events of my destiny), kept providing me with hallucinatory samples of small print: ". . . the only specimen so far known . . ." ". . . the only specimen of *Eupithecia petropolitanata* was taken by a Russian schoolboy . . ." ". . . by a young Russian collector . . ." ". . . by myself in the Government of St. Petersburg, Czarskoe Selo District, in 1912 . . . 1913 . . . 1914. . . ."

Then came a June day when I felt the urge to push on still farther and explore the vast marshland beyond the Oredezh. After skirting the river for three or four miles, I found a rickety footbridge. While crossing over, I could see the huts of a hamlet on my left, apple trees, rows of tawny pine logs lying on a green bank, and the bright patches made on the turf by the scattered clothes of peasant girls, who, stark naked in shallow water, romped and yelled, heeding me as little as if I were the discarnate carrier of my present reminiscences.

On the other side of the river, a dense crowd of small, bright-blue male butterflies that had been tippling on the rich, trampled mud and cow dung through which I had to trudge rose all together into the spangled air and settled again as soon as I had passed.

After making my way through some pine groves and alder scrub I came to the bog. No sooner had my ear caught the hum of diptera around me, the cry of a snipe overhead, the gulping sound of the morass under my foot, than I knew I would find here quite special arctic butterflies, whose pictures, or, still better, non-illustrated descriptions I had worshipped for several seasons. And the next moment I was among them. Over the bilberry shrubs, with fruit of a dim, dreamy blue, over the brown eye of stagnant water, over moss, over mire, over the intoxicating racemes of the lone and mysterious marsh-rocket, a dark little Fritillary, bearing the name of a Norse goddess, passed in a low, skimming flight. I pursued rose-margined Sulphurs, grey-marbled Satyrs. Unmindful of the mosquitoes that coated my forearms and neck, I stooped with a grunt of delight to snuff out the life of some silver-studded lepidopteron throbbing in the folds of my net. Through the smells of the bog, I caught the subtle perfume of butterfly wings on my fingers, a perfume which varies with the species—vanilla, or lemon, or musk, or a musty, sweetish odour difficult to define. Still unsated, I pressed forward. At last I saw I had come to the end of the marsh. The rising ground beyond was a paradise of lupines, columbines, and pentstemons. Mariposa lilies bloomed under Ponderosa pines. In the distance, fleeting cloud shadows dappled the dull green of slopes above timber line, and the grey and white of Longs Peak.

I confess I do not believe in time. I like to fold my magic carpet, after use, in such a way as to superimpose one part of the pattern upon another. Let visitors trip. And the highest enjoyment of timelessness—in a landscape selected at random—is when I stand among rare butterflies and their food plants. This is ecstasy, and behind the ecstasy is something else, which is hard to explain. It is like a momentary vacuum into which rushes all that I love. A sense of oneness with sun and stone. A thrill of gratitude to whom it may concern—to the contrapuntal genius of human fate or to tender ghosts humouring a lucky mortal. □

# *Weekend Field Trips for Members*

## to

## Starved Rock, Illinois
## Galena, Illinois
## Baraboo, Wisconsin

*Historic Galena*

By popular demand, Field Museum's weekend trips to Starved Rock, Galena, and Baraboo are being offered again this year, with two weekends to choose from for the Galena and Baraboo trips.

**Starved Rock.** Dr. Gordon Baird, assistant curator of fossil invertebrates, will lead the group on the weekend of June 16-17 to Starved Rock State Park; Buffalo Rock State and Matthiessen State Park will also be toured. Eighty miles southwest of Chicago, Starved Rock is so named for a 125-foot-high sandstone outcrop, where a group of Illini Indians more than 200 years ago took refuge from another attacking tribe. The park is notable for its 19 canyons and their remarkable vistas. Tour members will stay at Starved Rock Lodge. Tour cost: $82.00.

**Baraboo.** Dr. Edward Olsen, curator of mineralogy, will lead tour members through the Baraboo range and along the shores and hinterland of beautiful Devil's Lake. Two tours are scheduled: May 19 and 20, and June 9 and 10.

The Baraboo Range is of special interest as a *monadnock*—what is left of an ancient mountain range and which now stands out above the younger rocks and sediments. The range consists of quartzite—more than one billion years old—which, although compressed in places into vertical folds, retains the original sedimentary structures. The mountains were further modified by glaciers, forming the lake and the picturesque glens, and changing the course of rivers.

Hiking clothes are strongly recommended for the scheduled hikes. The trip is not suitable for children, but younger people interested in natural history are welcome. The cost of the Baraboo trips is $70.00 per person.

**Galena.** Dr. Bertram G. Woodland, curator of petrology, will conduct two study tours through the geological area (once a lead-producing region) of this history-laden river town, which is built on rocky limestone bluffs. In addition to viewing geological features, tour members will have the opportunity to explore historic Galena's charming downtown area, with its unique variety of pre-Civil War architecture.

An overnight tour is offered for the weekend of May 5-6; per person: $98.00. A two-night, three-day tour is offered for October 12, 13, 14 at a rate of $150.00. Accommodations are at the Chestnut Mountain Lodge.

Rates quoted for all above tours are per person, double occupancy (single accommodations on request). Included are all expenses of transportation on charter buses and accommodations in first class resort hotels. The rate also includes all meals and gratuities, except personal extras such as alcoholic beverages and special food service. An advance deposit of $15.00 is required upon registration for each trip.

For additional information and reservations, call or write Michael J. Flynn, Field Museum Tours, Field Museum, Roosevelt Rd. at Lake Shore Dr., Chicago, Ill. 60605. Phone: 922-9410, X-251.

# What Is a Curator?

BY JOHN TERRELL

AS A MUSEUM CURATOR I am always uneasy when people ask me innocently enough: "What do you do?" It is my experience that if you say you are a curator, their eyes will glaze over with incomprehension. You are likely to get in reply something as noncommittal as "Oh, how nice." Or possibly: "Oh . . . How fascinating." Few people seem to feel comfortable admitting they are not sure what a curator does.

I became a museum curator more than seven years ago when I was hired at Field Museum of Natural History as an assistant curator in the Department of Anthropology. I had had absolutely no formal training in "museology." Throughout graduate school I had always assumed that I would end up as a professor, not a curator.

When I arrived at Field Museum in September 1971 I had in my mind the vague idea that curators look after museum specimens, do research that interests them, and help with public exhibitions. I suspect I would not have thought very differently even if I had taken museology courses, for it is my impression that such courses do not add up to very much. Today I think none of us can afford to be as naive as I was back then. What museum curators do is changing. We need to be aware of what those changes are. We also need to take a hand in bringing them about.

Traditionally a curator has been someone who is steward of a collection of things housed in a museum. This conception of the role of curator in a museum is, as far as it goes, perfectly correct. If I have any quarrel with it, my argument would be that today this traditional role is far too limited.

Like it or not, museum curators in the 1980s and beyond will have to be more than stewards of things. If museums are to take their place in the mainstream of life once again, all of us who call ourselves curators are going to find that we must increasingly also be managers of people.

By this I am not saying that the *goals* of museums as modern institutions should be altered. There appears to be considerable agreement throughout the museum world that the goals of any museum are at least these three: to foster scholarly research, to preserve artistic, historical, and scientific collections, and to be a force in popular education. Surely these are proper goals for museums, today and in the future. What is changing—and what I think needs changing—are the means to those important ends. And what a curator does is—or should be—part of those means.

According to convention, at least at our larger museums where the luxury of curator-specialists has been possible, the stereotype of a curator would be roughly as follows. A museum curator (inevitably portrayed as a man) is someone who is terribly dedicated to some esoteric part of human knowledge, such as the artistic achievements of Greece in the 4th century B.C., the peculiarities of frog genitalia, or the potential of thermoluminescence in artifact dating.

Also according to their frequent portrayal, a curator is someone who works quiet, long hours all by himself behind the closed doors of his office or laboratory. There he works for years surrounded by piles and piles of trays and boxes of minerals, or stuffed owls, or pinned spiders, or human bones and ancient stones. Finally one day this aging curator produces what we have all been waiting for all these years: a great monograph recording all that he has learned and all that he has discovered.

Like all stereotypes, this image of the dedicated curator-as-scholar is at best only a half-truth. Curators, especially at smaller museums, have always been more active in all the daily chores that need to be done around a museum. But what is changing today is that curators are being asked more and more to take on tasks that may have nothing to do with their scholarly interests and training. Their new responsibilities are taking them away from the things they love. Grumblings are growing louder in the curatorial ranks.

What is happening to museum curators? How reasonable are their complaints? The question is not only "What does a curator do?" but also "What *should* a curator do?" Let us consider some of the tasks of the modern curator.

**Research:** It is doubtful that a curator's office was ever an unassailable sanctuary for scholarly pursuits free from the cares and demands of running museums. Yet no museum official would seriously contest the view that scholars and scientists are not going to be very useful people to have around museums if they cannot do what their training has equipped them to do. The question then is: How should curators balance their research tasks against other demands on their time and energies? Since even curators are human beings, the inescapable conclusion is that curators cannot do too many things at once and still get anything done that is worth doing. And this is the reason why I say curators are going to find more and more that they must be managers of people as well as stewards of things. The solution, after all, to not being able to do something yourself is to help someone else do it.

**Preservation:** The technical, scientific skills recognized today as essential to be able to conserve and, if necessary, to restore ancient artifacts, works of art, and the like are only rarely part of a curator's training as a research scholar. Nonetheless, because they are stewards of museum collections,

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*John Terrell is associate curator of Oceanic archaeology and ethnology.*

curators must keep a watchful eye over how collections are stored, handled, studied, loaned, and exhibited. In short, they are responsible for the survival of the collections under their care, and at very least they must know when to call upon the services of the professional museum conservator.

**Teaching:** According to the *Oxford English Dictionary* the first definition of a curator is "One appointed as a guardian of a minor, lunatic, etc." This definition would shock many, if not most, curators, because traditionally museums have been successful in attracting scholars to be curators precisely because they could avoid there the terrors and frustrations of teaching the young. Indeed, one well-known curator years ago is said to have defined teaching as "throwing dubious pearls before genuine swine"! This attitude against teaching appears to be changing today. And it needs changing, although no one even now would propose that museums should stop being museums and become colleges or universities instead. On the contrary, we are beginning to see that museums can offer a kind of teaching experience that is, unfortunately, all too rare in colleges and universities. Stated simply, the kind of teaching that can be done very effectively at museums is what used to be called *apprenticeship* education, *i.e.*, learning by practical experience. I might add that if museums are to maintain both their academic excellence and the quality of museum exhibits and public programs, curators must help the institutions in which they work to compete aggressively in the academic market place for the best talent being produced by our nation's educational system. To do so, museums must assume part of the burden of educating potential museum professionals.

**Lecturing:** It is traditional for museum curators to give public lectures on their specialized fields of scholarship. Today curators should also be ready to lecture on the goals and programs of the museums they serve.

**Exhibitions:** Curators customarily help plan and execute public exhibitions designed both to educate and to entertain the museum visitor. As scholars and scientists, however, I think curators (and I include curators of education and the departments they direct) need to be concerned more than they often seem to be about making museology itself a true discipline. It may come as a surprise to many, but for the most part all of us in museums know next to nothing *in a scientific way* about how to make our exhibits entertaining, educational and genuinely effective. Too much of what we do in designing an exhibit is done by the seat of our pants. In truth, there is no way at present, for instance, to know beforehand how well an exhibit will work. This confused, frustrating state of affairs is a luxury museums can no longer afford. With their academic training, curators ought to be able to help improve that body of knowledge and technical skills called museology.

**Decision making and management responsibility:** The extent to which the curatorial staff at any given museum is pressed into such vital areas as fund-raising, personnel recruitment and management, and the like appears to vary greatly from one institution to another. It has not been unusual in smaller museums to find curators saddled with far too many administrative tasks, for which they may be little suited both in training and in psychological makeup. Unquestionably it is the duty of a museum's appointed management to make the best use of the training, talents, and inclinations of all personnel—including the curatorial staff—under its supervision. Yet it will not do to say that curators are not themselves part of the management team at most museums. It seems increasingly obvious that more and more people are reporting to them for advice, supervision, and daily guidance. At Field Museum, for example, curators customarily serve as legally recognized project directors for major museum exhibitions supported by state and federal grants. It has been said that a good manager is not someone who tells other people what to do, but rather someone who facilitates the work of those for whom he is responsible. Like a good museum director, therefore, I think we can also expect that a good museum curator will come to be judged more and more in the years ahead on how effectively he or she can serve as a good facilitator of the work that museums, as responsive institutions, should be doing in promoting research, education, and the preservation of artistic, scientific, and cultural collections that constitute the heritage of mankind.

**Planning for the future:** Curators as privileged scholars working on their own research goals without interference from the institutions that are their tolerant patrons are a thing of the past. But if curators are to be shouldered with museum responsibilities and problems, then they must also have a real voice in setting the near and more distant goals of their institutions. It may be naive of curators to view the time and effort taken away from their research work as a regrettable sacrifice. But it is only human to want to do what excites you most. And hopefully every curator likes his academic calling. Therefore, the sacrifice must be worth it. It is my feeling that people are willing to make such a "sacrifice" if they find that their contribution pays off in observable ways. For this reason I suspect curators must be asked to do more than participate in committee work and come up with helpful advice. They will need to feel that they are directly affecting management decisions about the goals and programs of the museums in which they work.

After only somewhat more than seven years as a museum curator I can hardly claim that my answer to the question "What is a curator?" is in any way the sole or best one that could be offered. But I do think that most of my colleagues at museums would agree that what a curator does is changing. That is the reason why it so difficult to know what to say when someone asks: "What do you do?" □

# METEOR-WRONGS

BY EDWARD OLSEN

*Photos by Carol Small Kaplan*

IT IS ESTIMATED that somewhere around 70 million meteorites fall into the earth's upper atmosphere each day. Only about 500 of them *each year* survive burning up and make it through to the ground. Over two-thirds of these end up in the oceans, because that much of the earth is covered with water. Most of the remainder fall in uninhabited places — deserts, bogs, grassy prairies, mountains, etc., where the chance of one being recovered is very slim indeed. Nevertheless, the sight of a "falling star" grabs the imaginations of people.

Most of the meteorites that are recovered result from the interest and curiosity of ordinary people. A rock that looks out of the ordinary, or out of place, will raise a question in a person's mind. Often such curious rocks are collected and saved—sometimes for a couple of generations—before being reported. Unfortunately, all the things collected are not necessarily meteorites. In fact, the vast majority are not.

Over the past eighteen years as a museum curator of a large meteorite collection I have been impressed by the number and variety of "meteor-wrongs" that have been brought in for identification. They are tributes to the ability of people to notice the unusual and try to find out what they've found:

● About 15 years ago I received a phone call from a gentleman in Los Angeles. He said he had recently taken a vacation trip to a remote lake in Oregon, and described in detail getting to the lake —a main highway to a county road, turning onto a jeep trail, and finally walking cross-country to this beautiful trout lake, nestled in the mountains. There, while fishing, he had seen a large, strange, hackly rock. It was so weird, in this remote place, that he just knew it had to have fallen there—a meteorite. So, he broke off a hunk and later, in a nearby town, arranged to have some men go to the lake and fetch the main mass to town. It weighed several hundred pounds and had to be hoisted onto a truck. When it got to town he had it crated and sent it on its way to the Field Museum in his old home town of Chicago. As a boy he had enjoyed the Museum and the idea of giving it a large meteorite tickled his fancy. On the phone he said he was flying to Chicago on business and would bring the sample piece he'd broken off with him. The crate would arrive by railway freight shortly afterward.

It really sounded good! The remote locality, especially in a low population state like Oregon, had everything going for it.

Well, he arrived a day later. When he unveiled the sample my heart fell. It was a fragment of coal-furnace ash—more commonly known as a "clinker." He was chagrined to say the least. A careful examination left no doubt. It was a clinker of the kind that used to be dumped from coal-fired home furnaces, or from steam locomotives. How did it get to such a remote valley in the Oregon mountains? Perhaps a prospector had long ago had a coal furnace for smelting ore. There were, however, according to the man, no signs of abandoned habitation. Besides, the clinker was so big it had to have come from a sizeable furnace.

Well, we never figured it out. For me it was the first of a long list of such mysteries.

● One day a farmer from southeastern Missouri dropped into the Museum with a paper sack containing—he believed—a meteorite. He spilled the contents onto a table. Out tumbled large fragments of green bottle glass! They were all in irregular shapes and looked like hunks that had been scaled off the sides of the large steel ladles used to pour molten glass in a glass factory. (When

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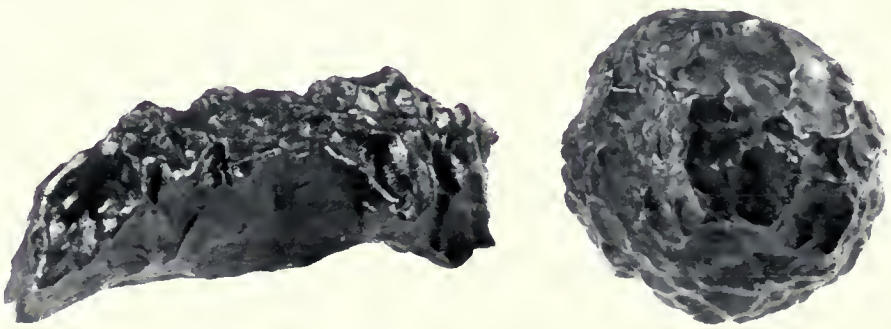
*Edward Olsen is curator of mineralogy.*



*A "right" and a "wrong": At the right is a pyrite nodule (3.5" long). Nodules of this kind form inside some sedimentary rocks. At the left is an iron meteorite (7" long). Both specimens have the same type of surface sculpting and the same color. A very close look-alike, the pyrite nodule is often brought to the Museum as a possible meteorite.*

the walls of the large ladles become too encrusted with glass they are hammered out and dumped.) The only trouble was that the farmer had plowed them up in his field! How did they get there? We never figured out that one either. His farm was nowhere near a glassworks.

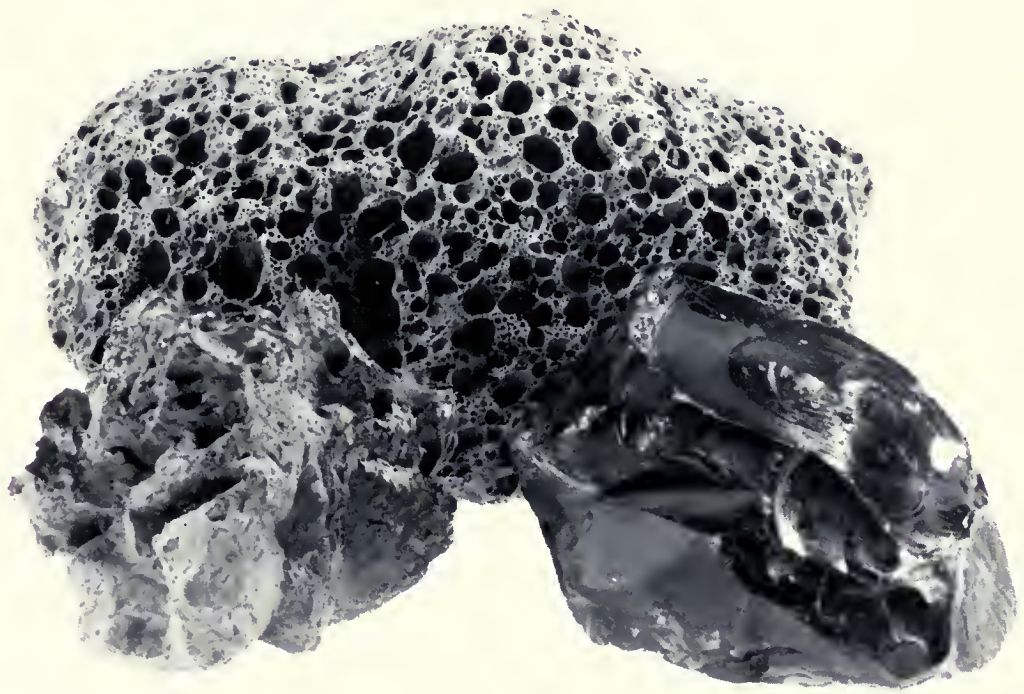
● A few years later, a farmer from southern Illinois came in with some "meteorites" he'd plowed up in his field. They were fragments and shards of bottle glass again—only this time it was deep blue glass! No explanation could be found. No glassworks were known in the area. It is, and has been, agricultural land since the first settlers came there, and the Indians before them did not make glass.

● One day in the mid-1960s, a man from Chicago's North Side phoned. He had been on a hike with his sons in the woods near the Wisconsin border and had come across a strange rock. It was shiny and metallic inside and had a thin black coating on the outside. It weighed many hundreds of pounds, by his estimation. He found a small chunk that had broken off the main piece and said it was very dense, like a piece of iron—certainly more dense than an ordinary rock. It sounded encouraging.

A few days later he came into the Museum with his sample. It was much as he described it. It has a density like metallic iron, but was utterly nonmagnetic. This one took the better part of a day for testing. It turned out to be a fairly pure piece of metallic manganese. Manganese oxide is black, and that accounted for the coating on the outside. Manganese metal does not occur naturally; it has to be refined in a mill from its oxide ores. Manganese is mixed with iron, in a steel mill, to make certain special alloys. This meant that a large mass of a refined man-made metal from some mill had somehow gotten hauled out to the woods along the Wisconsin-Illinois border north of Chicago. How did that happen?

Since that time, over the past ten years, I have had chunks of the same stuff, from the same general area, brought in at least four more times!

● Not too long after the first manganese incident I got a call from a man who said he'd found some bright, shiny, metallic object while digging in his yard. He wasn't able to get in to the Museum but mailed the object in. The first thing I noticed about the piece was how "undense" it was—very light stuff, indeed. Well, it took some time, but tests finally showed it to be a piece of very pure metallic silicon. Well, silicon doesn't occur naturally either; it also has to be refined by man, chiefly from its oxide form, called quartz. It is a difficult refining process. Silicon metal is used to make transistors and devices for electronic calculators.



*These three "meteor-wrongs" are all man-made. That in the rear (8" long) is a light, frothy siliceous slag from a steel mill. A chunk of furnace clinker (3.5" across) from a coal-fired furnace is at the left. At the right is a piece of dark blue bottle glass (4" across)—slag residue from a bottlemaking operation. Each of these specimens was brought in as a suspected meteorite.*

I never figured out how it got into the yard of a suburban house. Since then I've had at least half a dozen more pieces of the same stuff sent in or brought in, each from an unlikely place.

● A man who had been on a fishing trip in the Great Okeefenokee Swamp region of southern Georgia called one day. He told of putting his tent up on an island one evening. As he hammered in a tent peg it struck something metallic just a few inches below the surface of the soil. He dug it out. It was rusty on the surface, but very dense, like iron, and very magnetic. This sounded like a winner at last.

He finally managed to bring the object in to the Museum. It looked just like a weathered iron meteorite. It was flattish and almost two inches thick. I cut off a piece and went to work on it. It took most of a day. It had iron in it all right, and some nickel. But there was too little nickel to be a meteorite. It also contained a lot of chromium as well as small amounts of vanadium. Meteorite metal has neither of these. It was a chunk of man-made steel.

What was this piece of metal doing in a swamp, hundreds of miles from anything? It was too chunky and irregular to have been a part that might have fallen from an airplane. It was so rusty it had obviously lain there for a long time—so it couldn't be part of a satellite. It was another one we gave up on.

● On the near northwest side of Chicago the owner of a three-storey apartment building reported finding a meteorite on his roof. He described a white-to-pale gray rock that weighed at least 50 pounds. It didn't sound at all like a meteorite. I told him that even if it had been one, there would be no way for it to land on his roof—and stop there! A fifty pound meteorite would go right through to the basement.

He said it had to be a meteorite because he was thoroughly familiar with the flat roof of his apartment house and it was not there the last time he went up to the roof, some months before.

I went to his house one evening after work and looked at it. It was a large fragment of limestone, complete with some fossils in it. I left *him* with the problem of how a fifty pound chunk of limestone was hoisted onto the roof without him knowing about it—and why it was done at all!

● In the summer of 1977 I received a phone call from a lady in Wichita, Kansas. She said she had grown up on a ranch over 30 miles from Wichita, and ever since she was a child remembered a large iron meteorite her father had talked about that was out on the ranch. Were we interested? Yes, indeed!

She said she would go back to the ranch and bring it into town, where she had a house and yard. She called back a couple of days later to tell me she had it in town in her garage. She and her son had had to set up a block-and-tackle to lift it to the bed of their pickup truck. When it was lowered into the truck it bounced a bit and put a deep dent into the truck's steel bed. I told her that the best thing to do was to cut off, with a hacksaw, a small piece—say, something about the size of a 25¢ piece. That is usually big enough to make all the necessary tests.

About a week later she called again to tell me that she and her son were taking turns working the hacksaw. They had worn out at least a dozen blades and were nowhere near through. Finally, after another week had passed I received a package in the mail from the lady. I opened it eagerly, because I was convinced it had to be a winner. The piece of metal they had cut off was much larger than necessary. It was four inches across. They did a monumental amount of sawing by hand to get such a large piece.

*A type of quartzite, a terrestrial metamorphic rock known as a "graywacke." it occurs in outcrops in northern Wisconsin and Upper Michigan. Specimens found in the Chicago area were carried there thousands of years ago by glaciers, and are frequently thought to be meteorites. This specimen is 6" long.*

The metal was bright and shiny, just like a freshly cut iron meteorite. But clinging to one side of it was a black-colored slag that had thin fingerings into the metal. The metal was from a smelter —man-made! The main piece weighed many hundreds of pounds. It was smelted iron that had been dumped 30 miles from a city that is not a steel mill town. She found that hard to believe—and so did I.

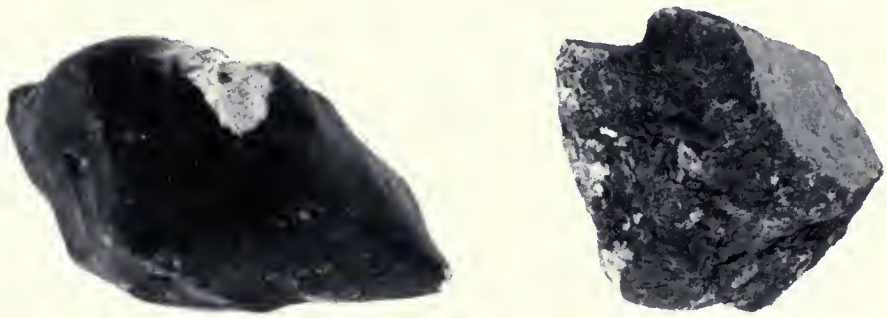
I could go on and on about hunks of metal or strange rocks that are found in crazy places. I've long ago stopped being amazed over such stuff. My biggest problem is trying to figure out what the objects are. People who bring in meteorwrongs are always disappointed they are not meteorites, and are naturally curious about the true nature of the objects they've collected. Of course, many, many of these things brought in are

ordinary terrestrial rocks that people think might be meteorites. Farmers are usually familiar with the bedrock of their area, so when they see something that is definitely not the local bedrock they suspect it might be a meteorite. All of the Midwest was glaciated thousands of years ago. The ancient glaciers carried boulders from regions in the north and dropped them in this central region. So, it's not unlikely for a piece of dark, gray or black basalt to end up in an area where the local bedrock is white limestone or tan sandstone. Such a mass of basalt stands out. Also, there's a process called *frost-heave*. A farm field that is clear of glacial boulders can have such boulders many feet down at the base of the soil. A series of hard winters can freeze the soil to a considerable depth. When the freezing takes place, the ice expands, and a buried glacial boulder can be pushed upwards slightly. After many years the boulder appears on the surface. A farmer, knowing it was clear land before, naturally concludes it had to have come from above—a meteorite.

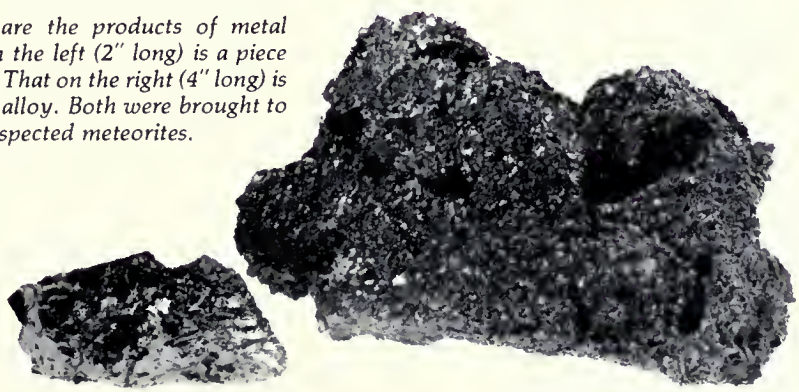
Such natural terrestrial rocks are relatively easy to identify. The man-made metals, alloys, slags, clinkers, glasses, and such, are not so easy.

The Field Museum isn't, of course, the only museum to face the problem of identifying meteorwrongs. A while back we were visited by a curator from the British Museum, which has the largest meteorite collection in the world. He told us about a supposed meteorite that fell on the evening of September 25, 1580:

It seems that Sir Francis Drake was engaged to a charming young lady. Before they were to be married, however, Drake was going on a sea journey. He left, and two years passed by as he went around the world. The girl despaired of his return, and her father, who wanted her married, arranged with another family for their son to marry her. The eve of the wedding arrived. Farmers in the area reported the fall of an iron meteorite. The girl said it was a sign from heaven that Sir Francis was returning, and called off the wedding. Well, sure enough, the next day Drake sailed into Plymouth harbor. All ended happily—the girl got her man, and the meteorite ended up being kept in Drake's large manor house. Centuries passed and the meteorite was always kept as a memento of the event. It got to be known as "Drake's meteorite." The curator from the British Museum recently visited the fine old English estate to examine this ancient treasure. Alas, another meteor-wrong—it was a cannonball!



*A stone "right" and a metal "wrong": The specimen at the left is an average stone meteorite (5" long). The other object is a close look-alike: a piece of refined manganese metal (5" long). The latter is man-made. The black coating on the outside of the manganese is manganese rust, which is pitch black in color. In appearance it closely matches the black fusion crust coating on the outside of the meteorite.*



*These specimens are the products of metal refineries. That on the left (2" long) is a piece of metallic silicon. That on the right (4" long) is of chromium-iron alloy. Both were brought to the Museum as suspected meteorites.*

# Volunteers Honored

An impressive, record total of 49,621 hours were contributed by 280 Field Museum volunteers in 1978. Volunteer work was performed in a variety of Museum departments and divisions: anthropology, photography, botany, education, exhibition, geology, zoology, the library, membership, public relations, and publications, among others.

Expertise was provided in cataloguing new acquisitions, textile conservation, collating, specimen identification, reorganizing old collections, typing, editing and writing, instructional facilitating, filing, and even in routine maintenance tasks.

In honor of their outstanding contributions, a buffet dinner was held for the volunteers in Stanley Field Hall on February 27. Museum President and Director E. Leland Webber presented gifts of appreciation to the volunteers; he gave special tribute to Sol Gurewitz, a Field Museum volunteer for eighteen years. The evening was concluded with a presentation of songs by Field Museum staff.

*Solomon Gurewitz* Carol Small Kaplan

## Solomon Gurewitz: The Volunteer as Unpaid Museum Professional

Most of Field Museum's staff rarely appreciate how unusually lucky we are in our volunteers, even though we seem to have more of them, and to get more and better work from them, than any comparable institution in the area. Visiting staff from other museums tend to be astonished when told that many volunteers here put in as much as several hundred man- or woman-hours in an average year. We, however, are not surprised. We take such remarkable performances almost for granted, and all because of one man: Mr. Solomon Gurewitz, the volunteer who set the pattern 18 years ago. He still works three days a week every week. Though unpaid, he is as professional as any member of the paid staff. All of us have come to expect that other volunteers will have at least part of the talent and dedication of a Gurewitz.

He came to the Museum in 1961, freshly retired and enthusiastically interested in Asian culture. As there was no regular volunteer program in those days, he had to talk his way in. He succeeded easily, being then as now a good talker. Within a month he had shown he was capable of doing many of the tasks of a trained museum anthropologist. Within a year he was an indispensable member of the Anthropology Department's staff.

He was given responsibility for rearranging and restoring the Museum's large Oriental collections. He became expert enough on these materials to give many lectures and to guide high-powered professional visitors to materials they wished to study. He was often asked to advise on materials for exhibition, on the selection and packing of loans, and on cataloguing. He helped with almost everything and took charge when necessary, having become a true jack-of-all-museum-trades.

About 15 years ago, he started to branch out in a new

direction. Much of the Museum's collection had never been photographically recorded even though, as he pointed out, contemporary museological standards required this for reasons of both security and research. He convinced the authorities that the Museum's regular photography department could hardly keep up with new accessions, much less work its way through the enormous backlog of unrecorded material acquired in earlier years. He received authority to set up a special photography section within the Anthropology Department. Since then he has been the departmental photographer. He and several associates, all volunteers, take several thousand highly professional pictures annually.

In the midst of this never-ending task, Sol still finds time to help orient new volunteers, to advise on numerous problems, to act as unofficial Departmental historian, and to be active in the Museum's professional and social life. It is an amazing achievement and, although we may appear to take it for granted, we are naturally both impressed and grateful. To show this gratitude, Sol was several years ago made an Associate of the Museum, and this year the annual Volunteer Party is being dedicated to him. But we have an ulterior motive besides gratitude. We want to publicize him as an example. His influence has already produced a few unpaid staff members almost as good as Sol. We hope that his example will help bring in more Gurewitzes in future years. — *Bennet Bronson, associate curator of Asian archaeology and ethnology*

## Special Recognition

**Over 500 Hours**

Patricia Talbot (828 hours): *Geology;* compiling Mazon Creek fauna guide

James Swartchild (742 hours): *Anthropology;* photography of new acquisitions and objects for special research and exhibition projects

Sol Century (714 hours): *Anthropology;* cataloging new acquisitions; working on plans for more efficient storage of collections

David Weiss (702 hours): *Anthropology;* working as general assistant to the curator; helping develop new security routines

Miya Esperanza Diablo (671 hours): *Education;* educational facilitator and statistical analyst

Jeanette Leeper (611 hours): *Anthropology;* textile conservation

Claxton Howard (607 hours): *Library;* sorting, typing, and reading room assignments

James Burd (606 hours): *Anthropology;* general assistant to the curator; in charge of planning departmental reorganization; cataloger

John O'Brien (598 hours): *Education;* assisting in preparation of Harris Extension materials and resources

Sol Gurewitz (579 hours): *Anthropology;* photography of new and unphotographed specimens; advising on Chinese collections

Peter Gayford (578 hours): *Anthropology;* editorial and research work connected with forthcoming catalog of Chinese rubbings

Alice Schneider (574 hours): *Anthropology;* editorial and research work on Chinese rubbings catalog

Burke Smith, Jr. (501 hours): *Zoology* (Division of Insects) curatorial assistance with orthoptera collection

**Over 400 Hours**

Louva Calhoun: *Anthropology;* illustrating stone tools for publication

Anne Leonard: *Anthropology;* tapacloth project researching

Margaret Martling: *Botany;* cataloging library reprints

Carolyn Moore: *Anthropology;* research and cataloging on Japanese collections

LeMoyne Mueller: *Anthropology;* conservation of North American Indian beadwork collection

Sylvia Schueppert: *Anthropology;* conservation of North American Indian beadwork collection

Eleanor Skydell: *Education;* researching and developing the Weaver's Walk for Adult Group Programs

**Over 300 Hours**

Virginia Beatty: *Botany;* organizing and cataloging collection of New Zealand hepatics and general assistant to curator

Rose Buchanan: *Education;* educational and public facilitator

Mark Clausen: *Public Relations;* editing and writing

Eugenia Cooke: *Zoology,* Division of Mammals; cataloging specimens; filing in departmental library

Connie Crane: *Anthropology & Exhibition;* researching Northwest Coast mythology and working on related projects

Julie Hurvis: *Education;* educational and public facilitator, and resource coordinator for Place for Wonder

Ira Jacknis: *Education;* co-developer for "Festival of Anthropology on Film"

Carol Landow: *Education;* educational and public facilitator

Withrow Meeker: *Anthropology;* cleaning and conservation of Chinese shadow puppets; work on Philippines collections

Debra Moskovits: *Zoology,* Division of Birds; researching and compiling a gazetteer for bird collecting localities in Brazil

Gary Ossewaarde: *Education;* exhibit facilitator

Elizabeth Rada: *Botany;* cataloging botanical periodicals and typing research monographs

Robert Rosbert: *Anthropology;* cataloging Kish and Pompeii collections

James Skorcz: *Library;* compiling reference statistics, interfiling directory additions, and reading room projects

Llois Stein: *Anthropology;* cataloging and researching Oceanic collections

Lorain Stephens: *Zoology,* Division of Birds; researching and compiling a gazetteer for bird collecting localities in Peru

Beatrice Swartchild: *Anthropology;* research on Philippine textile collections—to be published as a catalog. *Education;* statistical analyst

*Volunteer list continued on p. 34*

# ROSS'S ROSY GULL

Twice in the past four years this beautiful arctic species has been a mysterious visitor to the lower 48 states —once to Chicago, once to Massachusetts.

BY JANETTE NEAL

Not many birds make the front page of the *New York Times*, but the Ross's gull did. The appearance of one in Newburyport, Massachusetts, in 1975 was called the birding event of the century, and caused a sensation among bird lovers. The bird was seen and identified on March 2 of that year. On the morning of March 3, a group of 50 or so people, including the distinguished naturalist Roger Tory Peterson, who had left his Connecticut home at 3:45 a.m., waited and watched in the cold. At 10:00 they saw the Ross's gull feeding with a flock of Bonaparte's gulls. It was the 668th bird on Peterson's U.S. life list. As the word spread and the excitement grew, flocks of birders from the U.S. and beyond crowded into Newburyport. They lined the sea wall overlooking the Merrimack River estuary and the state beach on the Salisbury side of the river to see the gull. They frequently saw it feeding with Bonaparte's gulls three times daily. It didn't leave Newburyport until early May.

Then, less than four years later, another Ross's gull briefly made the bird-watching headlines. This one happened along the wintry shoreline of Lake Michigan, not far from the Chicago Loop. The bird was first spotted mingling with Bonaparte's gulls on November 29, 1978. The following day it was seen by several expert birders in the vicinity of Lincoln Park, a few miles north. The news spread quickly, and by December 2, a Saturday, dozens of eager birders braved the bitter onshore winds in search of the bird. It was seen fleetingly only once more, and never again. Hundreds of birdwatchers around the country waited in vain for one more sign that the bird was going to be as cooperative as the famous Newburyport gull, but this second sight record for the the "lower 48" vanished as suddenly as it had appeared.

The Ross's gull is usually found in the high arctic. Before the 1975 sighting, never before had one been seen so far south. This was the first sighting of the bird in the U.S. outside of Alaska. We can only speculate on how the bird, in 1975 and 1978, came to be so far from its usual habitat. It may have become separated from its own kind, joined a flock of Bonaparte's gulls in their breeding grounds in northern Canada and flown south with them. It may have been blown south by bad weather. Or it may have suffered from a case of mistaken identity and believed itself to be a Bonaparte's gull.

The Ross's gull has a circumpolar distribution in the arctic. It is seldom seen south of the Arctic Circle, although there are occasional sightings of the bird in northern Europe and Canada. Our knowledge of the gull is limited by the remoteness and inaccessibility of its habitat; however, we do know the basic facts of its life history. The gulls breed in Siberia, arriving there in late May or early June. They nest and raise their young quickly. By August they have left their nesting grounds and begun an eastward migration. They pour through the Bering Straits in September and October. They continue northeastward until they meet the pack ice and spend the winter at sea among the ice fields. In spring they follow the ice north as it melts, returning to their breeding grounds.

The Ross's gull is small for this particular bird group—12 to 14 inches (30.5-35.5cm.) long. In breeding plumage the head, neck, underparts, and tail are a delicate rosy pink. The back and wings are soft pearl gray. The trailing edges of the wings are white with gray outer tips. A narrow black band encircles the neck. The eyes are red, the feet vermilion. The beak is black and somewhat smaller and weaker than the beak of other gulls. The wingspan is about 10 inches (25.4cm.). The distinctive wedge-shaped tail is 5 inches (12.7cm.) at the center, 4 inches (10cm.) at the outer edges. The bird weighs 8 to 10 ounces (200-250gms.).

In winter the pink color fades to white, and the necklace disappears. A patch of gray appears on the back of the crown.

In juvenal plumage, the crown, neck, and mantle are brownish-black. The forehead and cheeks are white with dark patches behind the eyes. A dark band runs along the upper sides of the wings and back forming a W. The tail is white with a wide black terminal band. The feet are plum. The rest of the plumage is white with gray wing linings and considerable brown in the wing tips and coverts.

Newly hatched chicks are about 5 inches (13cm.) long. Their down is dusty yellow with flecks of gray and black. The flecks tend to be darker on the head and lighter on the flanks. The breast is unspotted and whitish. The eyes are dark brown. The legs, feet, and bill are flesh-colored or gray, with a brown tip on the bill.

The distinguishing characteristics of the Ross's gull are its pink color, its wedge-shaped tail, and the collar around its neck.

The bird has a higher, more melodious, and more varied voice than other gulls. Its flight is more buoyant and ternlike.

In summer the gull's diet consists of gnats, beetles, small mollusks, aquatic insects and larvae, worms, and crustaceans. In winter the diet consists of small fish and crustaceans.

The history of the Ross's gull is as interesting as the bird is beautiful. The first scientific discovery of the bird was made by Sir James Clark Ross, a nineteenth-century British arctic and antarctic explorer. Ross was born in 1800 and joined the Royal Navy at the age of twelve. Between 1819 and 1827 he sailed on four arctic expeditions with Sir William Edward Parry. In 1831 he was a member of Booth's expedition, and with his uncle, Sir John Clark, helped determine the position of the north magnetic pole. Ross led an expedition to the antarctic in 1839 with two ships, the *Erebus* and the *Terror*. He led an attempt to rescue Sir John Franklin in 1848/49 with the ship *Endeavor*. He was recognized as an expert on the arctic and antarctic until his death in 1862.

On June 27, 1923, Ross shot a gull at Igloolik on the east side of the Melville Peninsula in the Canadian Arctic. Parry's journal records the event:

*Mr. Ross had procurred a specimen of a gull having a black ring around its neck. and which, in its present plumage, we could not find described. This bird was alone when it was killed, but flying at no great distance from a flock of tern, which latter it somewhat resembles in size as well as in its red legs; but is on closer inspection easily distinguished by its beak and tail, was well as by a beautiful tint of most delicate rose-colour on its breast.* *

This was probably the first written description of the Ross's gull. Several days later another member of the expedition shot another gull. The two skins were prepared and carried back to Great Britain. One was given to the University of Edinburgh Museum, the other to a Joseph Sabine.

The bird was described from the Edinburgh skin by Dr. John Richardson and named the cuneate-tailed gull (*Larus rossii*) in 1824. At the same time William MacGillivray, assistant keeper of the museum, gave the bird the temporary name of Ross's rosy gull (*Larus roseus*). Both men intended for Richardson's names to be used, but somehow it was MacGillivray's names that stuck. Today the scientific name for the bird is *Rhodostethia rosea*, from the Greek words *rhoden*, meaning "rose," and *stethos*, meaning "breast"; and the Latin word *rosea*, meaning "rose-colored." MacGillivray proposed this name after he learned that the name *Rossia* was used as the generic name of a mollusk.

Virtually nothing more was learned about the Ross's gull for the next 50 years. In the 35 years after its discovery only two individuals were seen, one of them by Ross at Spitzbergen in 1827. In 1844 Audubon wrote that the only two Ross's gulls known to exist in museum collections were the two from the second Parry expedition. Audubon did not see or paint a Ross's gull. He confessed that, "not having met with this beautiful little gull, I am obliged to refer to Dr. Richardson's description of it in the *Fauna Boreali-Americana*."**

By 1881 only 23 specimens could be found in the world's museums, and no eggs or nests had been collected.

To illustrate the rarity and value of Ross's gull specimens, consider the story of R. L. Newcomb. In October 1879 Newcomb shot eight Ross's gulls from the ship *Jeannette*, which was imprisoned in the ice and drifting away from Wrangall Island towards the northernmost of the New Siberian Islands. Large numbers of the gulls were seen flying over the ice. In June 1881 the *Jeannette* foundered near Henrietta Island. Many men perished during the journey in the ship's boats across ice and water through the New Siberian Islands, across the Laptev Sea, to the Siberian mainland at the Lena River delta. Throughout the long ordeal Newcomb kept three skins under his shirt. Not only did he save the skins, they helped to save him by providing insulation against the cold.

In the late ninteenth and early twentieth centuries our knowledge of the Ross's gull increased greatly. Sightings were recorded and specimens collected. The basic facts of the bird's life history were determined.

In August 1894 Fridtjof Nansen shot eight

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*Journal of a Second Voyage for the Discovery of a Northeast Passage from the Atlantic to the Pacific Performed in the Years 1821-22-23 in His Majesty's Ships Fury and Hecla Under the Orders of Captain William Edward Parry (*London: John Murray, 1824*), *p. 449.*

**Audubon, John James,* Birds of America (*Philadelphia: Audubon, 1944*), VII, 130.

Ross's gulls from the ship *Fram*, which had been frozen in the ice pack for 10 months. Nansen left the *Fram* and saw more gulls about 30 miles northeast of Hvidtenland, the northeast group of the Franz Josef Archipelago. From July 11 to August 8 Nansen and his companion, Johansen, saw single birds and sometimes small flocks. The crew of the *Fram* who remained on the ship also saw Ross's gulls about the same time. Nansen saw the gulls again in August 1899 near Franz Josef Land. This made it clear that the birds inhabited the pack ice north of Franz Josef Land and Spitzbergen, and suggested that they bred farther west in Siberia, or that they migrated westward.

In 1897 S. A. Andree died attempting to cross the North Pole in a balloon. His body and diary were found in 1930 on White Island, which lies off the coast of North-East Land and between it and Franz Josef Land. The diary reported that after the balloon crashed Andree and his companions struggled 200 miles south. They saw 15 to 17 Ross's gulls 120 to 190 miles north of White Island in late July and August.

John Murdoch observed Ross's gulls at Point Barrow, Alaska, in the fall of 1881. For a month, beginning September 28, he saw the gulls traveling northeast. The next year he saw them from September 20 to October 9. In 1897 he saw only two Ross's gulls, on September 9 and 23. Murdoch reported seeing large loose flocks of the birds. He took more specimens, mostly immature birds, than were contained in all the world's museums at that time.

The gulls appeared at Point Barrow on gray overcast days with easterly winds. They flew in from the southwest, sometimes stopping to feed on the beach, then continued on to the northeast. They appeared and disappeared quickly. The birds were seen in the fall more or less regularly, but their numbers varied. Some years many were seen, some years few, or none at all. The fact that the birds were not seen at Point Barrow in spring or summer led Murdoch to guess correctly that their breeding grounds were west of Wrangall Island, and that they reached the breeding grounds by following the melting ice north, not by a return migration through Point Barrow.

Dr. Charles Brower was in charge of the trading post at Barrow in the 1920s. On September 26, 1928, thousands of Ross's gulls passed through Barrow. Brower wrote that he could have killed several hundred if he'd had the time. The skins were once so rare that they brought up to $200. By 1929 they were no longer so valuable. Although they were still eagerly sought by museums and collectors, they commanded a price of only $10 or so. Ross's gulls were shot for food by Eskimos and were eaten fried or roasted. They tasted like golden plover!

Sergius Buturlin conducted the major study of the species on its breeding grounds in 1905. He described the limits of the breeding area in northeastern Siberia—from the Kolyma River delta near the Arctic coast, south to Aby Mlaya and Svedne Kolymsk, east to the Chaun and Indigirka Rivers, and west to Swjatai Nos. The southern part of the area is forested, but most of it is a mixture of swamp, moor, wet ground, lakes and rivers. The birds nest in dense alder thickets, not on the open tundra.

Buturlin reported that the first gulls arrived on May 30. The next day he saw several dozen. They appeared tired, sitting quietly on the ice and not flying far away if they were approached. Buturlin found the gulls on a small shallow lake formed by snow melt, accompanied by terns and Sabine's gulls. They spent their time swimming, catching insects, and resting. The gulls were constantly seen in pairs, the males identifiable by their more intense coloration. The males courted the females by pecking at their heads and necks with open beaks, as if they were trying to kiss the females. The males stepped around the females, trilling, with their heads and breasts lowered, their tails and wings raised.

After June 3 the gulls dispersed and established territories. The males, and sometimes the females, defended the territories. The nests were constructed of dry grass, sedge stalks, dwarf willow and dwarf birch leaves and twigs, and often lined with lichens. They were built on small mossy areas free of wet grass or on small islands above the water. Some nests were built in hollows in patches of dry dead grass. The nests were shallow cups about 4 inches (10cm.) in diameter and ¼ inch (.6cm.) thick, standing 4 to 10 inches (10-25.4cm.) above the surface. The nests were generally damp.

The gulls nested in small colonies of four to thirty birds, almost always in the company of arctic terns. Other birds that shared the breeding grounds were glaucous-winged fulls, hoary redpolls, snow buntings, white-tailed eagles, willow ptarmigan, pectoral sandpipers, curlew sandpipers, dunlin, red and northern phalaropes, snipe, golden plovers, ruff, oldsquaw, white-fronted geese, bean geese, and whistling swans.

Buturlin found the first incubated eggs on June 13. By June 23 he had collected 36 eggs and 38 skins. On June 26 he found an egg close to hatching. There were usually three eggs per nest, but some nests held two or four eggs. The eggs measured 1.7 inches (43.3mm.) long and 1.2 inches (31.6mm.) wide. They were dark olive green spotted with chocolate brown. They were roundish, the small ends not pronounced, and more spotted towards the longer ends. The spots were not sharply defined and varied in color, some being lighter and some darker.

The incubation period lasted more than 3 weeks. Second clutches were sometimes laid if the first clutches were lost. During the day the females left the nests to feed. At night the males defended the colonies. The gulls constantly fought with the terns, making the colonies noisy places. The gulls'

*Continued on page 34*

# *Quetico Wilderness Canoe Trip for Members*

**July 19 - 29**

*Martin Oudejans*

QUETICO PROVINCIAL PARK, in western Ontario, is a mosaic of pure glacial lakes, pre-Cambrian rocks, and virgin boreal forest. Together with Minnesota's Boundary Waters Canoe Area, which it adjoins, this park is one of our continents's last remaining wilderness areas.

Field Museum is sponsoring for the fifth consecutive year, a canoe trip to Quetico for its high school-age members. The Voyageur Wilderness Program, of Atikokan, Ontario, is cosponsor. The ten-day trip is not primarily for fishing, nor is it a crash course in ecology; rather, it is intended as a wilderness experience and, as such, can mean different things to different participants. To truly experience wilderness is to forsake many of the comforts and crutches of civilized life. It means hard work —paddling long hours and carrying canoes and gear over portage trails that range from a few yards to more than a mile long. But it also means entire days during which one's group will encounter no others; it means lakes clean enough to drink from; it means periods of intense silence and opportunities to see wild animals and to experience the northern lights.

The group of 30 will be divided into single-sex units of five or six persons, each with a counselor or guide. All equipment, food, and guide services, as well as bus transportation between Field Museum and Quetico are included in the trip cost: $225.00. Applicants must be between 14 and 19 years old. Previous camping or wilderness experience is not necessary. The prime qualifications are proven swimming ability, good health, maturity and reliability. All applicants will be interviewed by Field Museum counselors; the deadline for applications is May 25. Those chosen for the trip will be so notified by June 2.

Slide presentations by Voyageur Wilderness Program representatives will be given on Field Museum's Members' Nights, May 2, 3, and 4. Program times and location will be announced in Members' Night literature or may be obtained by phoning 922-9410, X-251. For an application or additional information, phone or write Michael J. Flynn, Field Museum Tours, Field Museum, Roosevelt Road at Lake Shore Drive, Chicago, IL. 60605.

## *ILLINOIS ARCHEOLOGY FIELD TRIP*

For many of us, the word "archeology" conjures up visions of great architecture in distant places: Egypt's Pyramids and Sphinx, Cambodia's Angkor Wat, and Mexico's Pyramids of the Sun and Moon at Teotihuacan. These sites, with their relics, are limitlessly fascinating.

But right here in Illinois we also have exciting archeological sites, including the largest aboriginal structure north of Mexico—Monk's Mound at Cahokia. One of the most broadly based archeological research centers in the country is the Foundation for Illinois Archeology, at Kampsville; and one of the largest covered excavations with the longest continuing research programs is at Dickson Mounds, near Lewistown.

If you are interested in learning more about Illinois prehistory, as well as how scientific archeological research is conducted, you can join the Field Museum field trip of June 1-5, which will visit Dickson Mounds, Kampsville, and Cahokia Mounds. Limited to 30 participants, the trip includes site visits, lecture and slide presentations, workshops and discussions led by staff archeologists working at the respective sites. The field trip director is Robert Pickering, a doctoral candidate at Northwestern University.

The per person cost of this field trip is $240.00. For full details and registration information, write or call Michael J. Flynn, Field Museum Tours, Roosevelt Rd. at Lake Shore Drive, Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.

*Helton Mound, in the Lower Illinois River Valley, is typical of the sites to be visited during the June archeology field trip.*

# Observations On the Mutability Of Time

BY ALAN EDWARD RUBIN

About 600 years ago Geoffrey Chaucer wrote:

*The tyme, that may not sojourne,*
*But goth, and never may retourne,*
*As water that doun renneth ay,*
*But never drope retourne may,*

and therein expressed the obvious irreversibility of time. More recently, in "Chronomoros," Edward FitzGerald told of time's unvarying flow:

*Whether we wake or we sleep,*
*Whether we carol or weep,*
*The Sun with his Planets in chime,*
*Marketh the going of Time.*

These phrases typify the concept of time as inexorably ticking away, marking the passage of innumerable events and relegating them to an indifferent oblivion. The sands of time flow on.

Contrary to the notions of Chaucer and FitzGerald, however, time cannot be considered as flowing at a constant rate along a one-way street. The measurement of the finite velocity of light (first performed by the Danish astronomer, Olaus Roemer, in 1676) lay the groundwork for the destruction of this concept.

Light is the carrier of information, be it the spectral type of the nearest stars, the radial velocity of a remote galaxy, or the fact that there may be an ideal green wall clock on the other side of my office indicating a time of 9:07:04 to me.

At a speed of approximately 300,000 km/sec, the light reflected off the clock will span the five meters to my eye in less than 0.000000017 second. For all practical purposes, then, when I observe the clock to say 9:07:04, it actually *is* 9:07:04.

Suppose I sent my cousin (of whom I'm not very fond) 300,000 kilometers away, lent him a telescope, and asked him to observe my wall clock. Clearly, it would take light precisely one second to travel from the clock to my cousin. When he reads 9:07:04, fully one second will have elapsed since the clock indicated that time to me. At that point, I will read 9:07:05. Another observer, 600,000 kilometers from my clock would judge it to be just 9:07:03. It can now be seen that there must be a quantum of light carrying that information of 9:07:04 along with it, and if one were to ride on the light beam, it would stay 9:07:04 forever.

At the speed of light, time stands still—in contradistinction to what I observe while sitting and watching my clock successively ticking off 9:07:04, 9:07:05, 9:07:06. . . .If I were astride the light beam, however, I would be moving at 300,000 km/sec relative to the clock, while in reality I'm not moving with respect to the clock at all. If I were to suddenly increase my velocity relative to the clock, I would notice a corresponding slow-down in the passage of the clock's time. The faster I went, the longer it would take the clock to get from 9:07:04 to 9:07:05. I would be able to measure how sluggish my wall clock had become by glancing at the Timex on my wrist. My Timex would tick away the seconds at the same rate my wall clock did before I started moving. But since my wristwatch would not be moving relative to me, it would be keeping what is referred to as "proper time." We can define proper time as the time kept by a clock that is stationary with respect to the observer.

Let us imagine that my cousin has come back to earth for the moment to find me. I owe him money. As he enters my office, he notices me jumping out the window at 259,000 km/sec. Quickly, he pulls out his telescope and focuses on my wristwatch. He notes that two seconds of the wall clock pass for every one second indicated by my Timex, and concludes that my wristwatch is in bad adjustment. But the sluggishness he observes on my Timex is exactly equivalent to the sluggishness I observe on the wall clock back in my office. It can now be seen that an observer will note that every relatively moving clock is slow; the faster the relative velocity, the slower the moving clock seems to run.

This effect is known as "time dilation" and has been experimentally verified in the decay of high-speed muons. Muons are unstable massive sub-atomic particles that break down very rapid-

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ly. In fact, half of the muons that are stationary with respect to an observer will have decayed in about one millionth of a second. However, if an observer locates some muons which are moving relative to him, he will note that the muons live longer. The faster the muons are moving, the longer they will seem to live.

So far, I have only discussed the apparent sluggishness of time in systems which are in relative motion. Many of the examples presented above are derived from Einstein's special theory of relativity. Time also appears to slow down, however, when it is being measured in a system that is being accelerated or in one that is experiencing a gravitational field. Before we discuss this, it is germane to illustrate Einstein's "principle of equivalence," which states that the effects of gravitation are completely indistinguishable from the effects of uniform acceleration.

Suppose I were to go to the moon (where the effects of air resistance are zero) and take along with me a cough drop and a silver dollar. Placing the cough drop in one hand and the silver dollar in the other, I will experience the weights of each of these objects as pressures on my hands and will judge that the weights differ. If I were to move my hands quickly downwards, the pressures exerted by these objects on my hands would decrease. An increase in the downward motion of my hands would correspond to a decrease in the pressure exerted by these objects. If I were to continue this motion ever more rapidly, there would come a time when the objects would fly off my palms and lag behind in the downward motion. This will occur when the downward motion of my hands exceeds the free fall velocity of the objects. Now, the cough drop and silver dollar will fall at the same rate, remaining at an equal height, although they are no longer in contact with my hands.

Let me now capture a scientifically minded small green demon and imprison him in an opaque box along with the cough drop and the silver dollar. The box rests comfortably in my hand. When my hand is at rest, the demon will note that the cough drop and silver dollar have different weights by placing them on a tiny green scale he always carries in his pouch. If I were to bring my hands downwards, the demon would note a sudden decrease in the weights of the objects. He would not be able to tell that the box was moving since he could not see through the walls. Again, if the free fall velocity of the objects were exceeded by the downward movement of my hand, the cough drop, silver dollar, scale, and demon would all start flying upwards. It would be as if these formerly heavy objects had suddenly aquired a negative weight, or that gravitation, which had up to that moment always acted downwards, suddenly began acting upwards.

The demon could conclude that either the box was being accelerated in the direction of the unaltered gravitational field or that the masses below the box, which previously had pulled everything down, had disappeared, and new masses had appeared above the box, pulling everything toward the ceiling. There is no known experiment that the demon could perform inside the box to distinguish between these two possibilities.

Let us now examine how time is altered by the presence of either a uniform acceleration or a gravitational field. Imagine a freely floating glass room which is far out in space and subject to no gravitational influences. My cousin and I are inside, having tea. Outside the room is a circular disk which is rotating at a constant velocity. After synchronizing our watches, we decide to perform a little experiment. My cousin leaps onto the circular disk and fastens himself there securely. After a while, we decide to compare watches and I notice that my cousin's watch is running a bit slow. We repeat this experiment several times more, varying only the distance from the center of the rotating disk to the point where my cousin straps himself down. I observe that the farther my cousin is from the center of the disk, the faster he is being accelerated and the slower his watch appears to run. Since Einstein's principle of equivalence equates an accelerating system with one that possesses a gravitational field, it can be concluded that clocks will also run slow when subjected to gravitational attraction.

In an intense gravitational field, time will be much slowed down with respect to a distant observer. In the vicinity of a black hole, the distortion of time is maximized. A black hole gets its name from the fact that no light can escape from it and it can therefore never be directly observed. Around every black hole there is a spherical boundary called the event horizon, which lies at a radius (numerically equal to 2.95 kilometers times the mass of the black hole in solar mass units) from the singularity inside. Any shoe, cat, rocketship, cigar, gastropod, or light beam that penetrates the event horizon will be swallowed up by the black hole and never emerge. The closer these objects come toward the event horizon, the slower the time will appear on their clocks as judged by a distant observer. Consequently, such an observer would never actually see any of these objects penetrate the event horizon. They would appear frozen at the surface of this boundary with their clocks remaining stopped for all infinity.

Let us assume that I have just discovered a nonrotating black hole of ten solar masses and decided to send my cousin to investigate it. His mission is to approach and penetrate the event horizon, while keeping his clock on display at the stern of his spacecraft. I remain a good safe distance away. When my cousin is only 33 km from the hole, three seconds on my Timex will pass for every one second recorded by his clock. Events at this distance from the black hole transpire at one-third their normal rate.

As my cousin's spacecraft came closer to the event horizon, his clock would run ever more slowly. It would take an infinite time for the clock to tick at the event horizon and the spacecraft would appear to be suspended there forever.

My cousin, however, would not see himself as being frozen against the boundary of the event horizon. He would pass through it in what he would judge to be a reasonable amount of time and notice no strange pathological effects whatsoever. A glance at his clock would indicate to him that his was functioning quite normally and if he were to look back outward toward my Timex, he would find it corresponds rather well with the clock in his ship. (The only discrepancy he would notice would be due to the relative motion of his clock with respect to mine, as discussed above.) The observation of his ship being frozen against the event horizon is therefore only a consequence of my point of view from the outside.

Although I would be able to see my cousin poised in space forever, he himself would be heading toward the center of the black hole. As he approached the center, the tidal forces would grow ever stronger. Assuming the hole was ten solar masses, he would reach the center in 67 millionths of a second according to his clock after he penetrated the event horizon. The tidal forces, however, would have torn him apart long before this. At the center of the hole there would be a singularity, a mathematical point containing all the mass of the hole, including, now, my cousin's. It is an object of zero volume, and consequently of infinite density. I could then assume that my cousin would not participate in any of my future experiments.

I have stated above that "time cannot be considered as flowing at a constant rate along a one-way street." I have shown that time slows down with increased velocity according to the postulates of special relativity and that gravitational fields also will cause clocks to slow in accord with general relativity. So much for time's constant rate. But what about the second part of my statement? Can time still be thought of as flowing along a one-way street? Perhaps time can be slowed down and stopped, but can it ever actually flow backwards? Is the irreversibility of time absolute?

According to electromagnetic quantum field theory, an anti-particle moving forward in time is equivalent to a particle moving backward in time. In the nuclear physical process of pair production, a photon is annihilated and an electron and a positron (an anti-electron) are created. The positron can be represented by an electron going backwards in time. This postulate was first presented by R. P. Feynman in 1949, but it must be kept in mind that this time-reversal anti-particle equivalence has not been empirically verified. Perhaps it is empirically unverifiable. Nevertheless, mathematically, at least, time can be considered as occasionally flowing backwards when dealing with particle—anti-particle pairs.

There is yet another mathematical solution dealing with the reversibility of time that stems, in this instance, from some of the theoretical speculation about black holes. If you recall, the black hole that I sent my cousin into was nonrotating. But just how reasonable is it to suppose that any star (including black holes) would possess no rotational velocity? Our sun rotates (with a period at its equator of 25.4 days); the pulsar—neutron star in the Crab Nebula rotates (about 30 times each second); in fact, all stars rotate. In general, the more massive the star, the greater is its rotational velocity. In order for a star to have collapsed upon itself to form a black hole, it must have been at least three times as massive as the sun. As the star's radius decreased, the potential black hole would have had to rotate more rapidly in order for angular momentum to have been conserved.

From this we can conclude that a nonrotating black hole is most likely a fictitious entity. It was necessary to consider the nonrotating hole, however, because up until 1963 there were no known mathematical treatments that could account for rotation of black holes. In that year, R. P. Kerr published such a treatment. Instead of the black hole having one event horizon, there are actually two. Also, a trip through the first event horizon does not necessarily doom the traveller into being sucked up by the singularity. It is possible for him (if he chooses his course carefully) to pass through the event horizons and emerge in another universe. Once there (wherever that might be) our adventurer could conceivably find another rotating black hole and return to our own universe at any point in time that he may choose. The Kerr solution allows him to possibly return to earth a million years in the future or ten billion years before he left.

The main flaw in this solution is that it is necessary when performing the calculations to entirely disregard the star that created the black hole in the first place—a most fundamental oversight. This "wormhole" to the future or the past must therefore be regarded as a purely mathematical construction, and one that, given our present state of knowledge, cannot be taken too seriously.

What, then, is time? It cannot be defined as flowing at a constant rate, as has been shown by special and general relativity. Moreover, there are certain mathematical solutions which seem to question time's apparent irreversibility. But in the daily personal worlds of most of us, time seems to exhibit no behavioral abberations, for this is in fact the world for which the concept of time was created, as a classically useful and fundamentally human expedient. □

# FIELD MUSEUM TOURS

## *Exclusive Tour Packages for Members and Their Families*

*Fabulous Machu Picchu, one of the sites to be visited on Field Museum's Peru tour.*

# PERU

IN 1978 FIELD MUSEUM was host to a dazzling exhibit of golden treasures from ancient Peru. Now Field Museum members and their families can visit some of the archeological sites where those treasures were discovered. A 20-day tour (Oct. 27-Nov. 15) will visit the famed ruins of Machu Picchu, Chan Chan, Pachacamac, Purgatario, and others. Also on the itinerary are the Plains of Nazca (viewed from low-flying aircraft), the offshore Guano Islands, and the famous Pisac Indian Fair. The group, limited to 20 persons, will be led by Dr. Michael Moseley, associate curator of middle and South American archeology and ethnology, and by Robert Feldman, assistant in archeology. Both Moseley and Feldman have done extensive archeological work in Peru; a tour escort will also accompany the group.

The tour cost—$2,998 (which includes a $500 donation to Field Museum)—is based upon double occupancy and includes round trip air fare between Chicago and Peru, as well as local flights in Peru. Delta Airlines will be used between Miami and Chicago, connecting with Aeroperu.

Deluxe hotel accommodations will be used throughout. The package includes all meals, including inflight meals; all sightseeing via deluxe motor coach; all admissions to special events and sites, where required; all baggage handling throughout, plus all necessary transfers; all applicable taxes and tips; all applicable visa fees. Advance deposit required: $250.00 per person.

**FIELD MUSEUM TOURS**

# COOK ISLANDS

THE UNIQUE OPPORTUNITY to see a hidden corner of the fabled South Seas awaits a select group of Field Museum Members. Accompanied by three staff scientists, from July 14 to 31, a visit to the Cook Islands will involve comfortable living in a still-unspoiled paradise. It will be the dry season, with clear lagoon waters, sunshine guaranteed, and comfortable temperatures.

Located between Tahiti and Fiji, the Cook Islands offer one of the last relatively unspoiled island areas. Rarotanga, with towering peaks and narrow valleys, is surrounded by a reef and coral islets. A new 150-room hotel provides a base with modern comforts. Aitutaki, an hour away by small plane, is a classic atoll lagoon, rich in marine life and superb for snorkeling or SCUBA diving. There, a comfortable, country-style hotel will provide two nights' accommodation right next to a lagoon reef, with the simple, friendly services of the Polynesian community. Mangaia, also a short flight away, will be visited for a day, with an inland hike and a journey to the lagoon areas. The last three days of the tour will be spent in Hawaii.

The tour's scientific lecturer/escorts will be Dr. Alan Solem, curator of invertebrates, Dr. Robert K. Johnson, associate curator of fishes, and Dr. Elizabeth L. Girardi, research associate in invertebrates. Dr. Solem has participated in many expeditions to this part of the globe and has written extensively on its fauna. Dr. Johnson, a certified SCUBA diver and expert on coral reef fishes, has participated in many diving expeditions to both the South Pacific and the Caribbean. Dr. Girardi has also made many collecting trips to the South Pacific, concentrating on marine invertebrates.

The tour, limited to 25 persons, will travel via Air New Zealand. The tour cost—$2,650 (includes a $400 donation to Field Museum)—is based upon double occupancy and includes round trip air fare to and from Chicago. Also included is all interisland transportation, all meals (except lunches in Hawaii) and all inflight meals, all admissions to special events, where required; all baggage handling, plus all transfers, all applicable taxes and tips. Advance deposit required: $400 per person.

For full itinerary and other information, write or call Michael J. Flynn, Field Museum Tours, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.

*Tour members will stay at the Rarotangan, the Cook Islands' new luxury hotel.*

Air New Zealand

VOLUNTEERS *continued from p. 23*

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GULLS *continued from page 26*

only enemies were skuas and vega gulls, which took eggs and chicks. Buturlin found that the gulls showed little fear of humans. If he disturbed them from their nests, they would return if he remained quiet as close as 30 or 40 yards away.

Buturlin found three-day-old chicks on July 1. On July 6 and 7 he found seven downy young in different stages of growth. The chicks hid from humans in clumps of carex, where they were well camouflaged, or they avoided humans by creeping through the grass to water and swimming away. The adults tried to distract humans by fluttering low over ground or water, then settling on the water, calling, and looking here and there. Sometimes they even tried to draw the human's attention to terns' eggs or nests by fluttering near them or landing near them. Fights with the terns were likely to ensue.

The gulls began to leave the breeding grounds as soon as the young were strong enough to fly. This could be as soon as 20 days after hatching. On July 22, Buturlin found only three immature birds, and by August the breeding grounds were deserted.

Relatively little has been learned about the Ross' gull since Buturlin's study. Much remains to be learned, but no matter how much is learned about the bird, it will retain its aura of mystery and fascination. It is a symbol of the endless enchantment of the arctic. This small dainty-looking bird not only manages to survive in one of the most severe climates on Earth, it thrives there. □

# April and May at Field Museum

*(April 15 through May 15)*

### New Exhibits

**"The Art of Being Huichol."** Opens May 5. Members preview May 2, 3, and 4 during Members' Nights. A major traveling exhibition of more than 150 objects of Huichol Indian art. The exhibit was organized by the Fine Arts Museums of San Francisco and is sponsored by a grant from the National Endowment for the Arts and by the Museum Society of the Fine Arts Museums of San Francisco. The exhibit includes costumes, votive objects, weavings, embroidery, beadwork, and yarn "paintings." The "art of being Huichol" is the act of living a devout life, and spiritual themes dominate their art. The Huichol also value visionary experiences produced by the hallucinogenic peyote and these images are reflected in their dramatic yarn paintings. The Huichol live in an isolated area of Western Mexico, and they remain one of the few traditional Indian groups whose ancient beliefs and practices remain unchanged even today. Through September 3, Hall 27.

**"Lacquer Arts of Japan."** Opens May 9. More than 150 delicate objects comprise this exhibit of exquisite lacquer art from 18th- and 19th-century Japan. "Lacquer Arts" is planned in conjunction with "Japan Today," an international festival being held nationwide during April, May, and June. The objects displayed include items recently donated to the Museum by John W. Leslie as well as specimens loaned by another Chicago-area collector. On view will be finely crafted *inro* (small sectional lacquer cases used to carry medicine), *ojime* beads, and *netsuke* (miniature carved pendents which hang from silk cords). Portable shrines made of pins can also be seen. Examples of early Chinese lacquer art will be exhibited for comparison. Hall 32.

### Continuing Exhibits

**Feather Arts: Beauty, Wealth, and Spirit from Five Continents.** Opened February 15. Conceived and created by Field Museum's own staff, this exhibit features exotic feather objects from around the world. Assembled almost entirely from in-house collections, "Feather Arts" will travel to other museums nationwide after its stay at Field Museum. The 260 artifacts, drawn from 1,000 years of history, include such rarities as an Hawaiian king's feather cape given to England's George IV in 1821, and the feather shoes of an Australian sorcerer. This fascinating exhibit examines the symbolic and religious meaning of feathers over the centuries and illustrates the importance of featherwork as a universal art form. Hall 26. Through June 15.

**A Stamp Sampler: Postage from Natural History.** This exhibit unites 63 natural history specimens with samples of philatelic art. Projected to eventually cover the four disciplines of natural history, the exhibit for the first 8 months is devoted to the animal kingdom as illustrated on stamps from all over the world. "A Stamp Sampler" was conceived by Col. M. E. Rada, exhibit guest curator. The exhibition was designed by Peter Ho, a University of Illinois graduate student.

### New Programs

**"Peru and Its Birds."** An illustrated lecture with David E. Willard, custodian of Field Museum's bird collection. Wednesday, April 18, 1979, at 8:00 p.m. Peru has one of the most diverse bird populations in the world. Dr. Willard spent 10 months there studying fish-eating birds and searching for new species. He surveys the major groups of Peruvian birds and discusses their ecology and behavior in this slide lecture. James Simpson Theatre. Members, $1.50; Nonmembers, $3.00. A Members' dinner precedes the lecture at 6:30 p.m. Dinner: $7.50. Phone: 922-9410, X 364 for reservations.

**"American Indian Featherwork."** A free demonstration of American Indian featherworking techniques with Dixon Palmer, an Indian of Kiowa and Choctaw descent. Saturday and Sunday, April 21 and 22, 1979. 10:00 a.m. - 12 noon; 1:00 p.m. - 3:00 p.m. Stanley Field Hall. Mr. Palmer, whose Indian name is *Tsain-Sah-Hay* or "Blue Hail," is a well-known expert in Indian featherwork. His specialty is creating beautiful feather warbonnets; he will demonstrate how these pieces are made, and explain what they mean in Indian culture.

**"Wings, Feathers, and Tales."** Story Theatre with Maria Thespians. Directed by Zivile Numgaudus. Saturday and Sunday, April 21 and 22, 1979, at 11:00 a.m. and 1:00 p.m. Delightful story-telling sessions about the importance of birds and their feathers in folklore of cultures around the world. Ms. Numgaudus, a drama teacher at Maria High School in Chicago, reads selected tales from North and South America, Canada, Hawaii, and New Zealand while her brightly costumed group interprets them through song, dance and drama. A program that will fascinate adults and children alike. Lecture Hall II. Members, $1.50; Nonmembers, $3.00. Tickets: 922-9410, X 364.

(Continued on back cover)

## Members' Nights

Mark your calendar now for Members' Night, Field Museum's annual open house for its Members, to be held this year on Wednesday, May 2; Thursday, May 3; and Friday, May 4.

As in the past, free round-trip charter bus service will be provided between the Loop and the Museum. These CTA buses, marked *FIELD MUSEUM*, will originate at the southwest corner of State and Jackson, with stops at the southwest corner of Michigan and Balbo. Two buses will be making continuous circuits, beginning at 5:45 and passing at about 15-minute intervals, until the Museum closes.

Plenty of free parking is available in Soldier Field lots and the Planetarium parking area, with a shuttle bus continuously circling the areas and collecting and discharging passengers at the Museum's south steps.

From 6 p.m. to 8 p.m. the Museum's food service area will provide complete dinners or snacks.

So plan your Members' Night visit now, reacquaint yourself with *your* Museum. Entertainment and educational programs will be offered on each of the three evenings, from 6 until 10 p.m.

# April and May at Field Museum

(Continued from inside cover)

### New Programs

**"The Edward E. Ayer Film Lectures"** take place throughout April. These free, adult-oriented travel films begin at 2:30 p.m. on Saturdays. James Simpson Theatre. Admission is free at the West entrance. April 21: "O Canada!" April 28: "Discover Japan."

**"Free Gamelan Concert."** Friday, April 20, at 7:00 p.m. Directed by Dr. Sue Carole DeVale. Field Museum's gamelan master class will demonstrate the Museum's 19th-century Javanese gamelan to members of the American Musical Instruments Society. Open to the public. Hall K, ground floor.

**"The American Bald Eagle."** A documentary filmed in the Florida Everglades, Alaska, and the Aleutian Islands which tells the story of America's endangered national bird. Saturday, April 28, 1979, at 10:00 a.m. and 11:00 a.m. This 16-minute film identifies the characteristics, life cycle, habitat, nesting and breeding habits of the majestic bald eagle, and stresses the need to continue vital conservation efforts. James Simpson Theatre. Admission is free at the Museum's West entrance.

**"Our Bald Eagle: Freedom's Symbol Survives."** With Thomas Dunstan, associate professor of biology at Western Illinois University. Sunday, April 29, 1979, at 2:30 p.m. Dr. Dunstan's slide lecture on the plight of the American bald eagle is based on his research of the last 10 years. He discusses the vital efforts being made to conserve the American bald eagle population. Harvey Webster, of the Cleveland Museum of Natural History, joins Dr. Dunstan and brings with him a live male bald eagle from the project on artificial breeding of captive populations in progress at the Cleveland Museum. James Simpson Theatre. Members, $1.50; Nonmembers, $3.00. Tickets: 922-9410, X 364.

**"Great Scientists Speak Again."** A series of six weekend film programs honoring the world's great scientists. Professor Richard M. Eakin, University of California at Berkeley, impersonates famous men of science and creates an authentic atmosphere using the language, dress, and manner of the times. Professor Eakin relives the important scientific discoveries, methods of study, theories, and personal philosophies of these historic figures through his imaginative portrayals on film. Admission is free at the West entrance of the Museum. "William Harvey": Friday and Saturday, May 4 and 5 at 2:30 p.m. A. Montgomery Ward Lecture Hall. "William Beaumont": Friday and Saturday, May 11 and 12, at 2:30 p.m. A. Montgomery Ward Lecture Hall.

**A series of anthropological films about Japan** will be presented in conjunction with "Japan Today" cultural festivities:
"Iyomande: The Ainu Bear Festival." Sunday, May 6, at 11:00 a.m. and 2:00 p.m. A. Montgomery Ward Lecture Hall. Made in the 1930s, this film studies the Ainu tribe on Japan's northern island of Hokkaido. Admission is free at the Museum's West entrance.
"Discovering the Music of Japan." Sunday, May 13 at 11:00 a.m. and 2:00 p.m. A. Montgomery Ward Lecture Hall. Three major Japanese instruments—the koto, the shakuhachi, and the samisen—are demonstrated by skilled Japanese musicians in this film.

**"Members' Nights."** Wednesday, May 2; Thursday, May 3; Friday, May 4. Field Museum's behind-the-scenes open house will be held on three consecutive evenings this year. From 6 p.m. to 10 p.m., the Museum offers a thrilling selection of activities—special displays, lectures, games, tours, and demonstrations—especially for Members. Research areas open at 7 p.m.

### Continuing Programs

**"Armchair Expeditions."** Geared for adult groups, these in-house "expeditions" include slide lectures and tours of selected exhibits. Dining arrangements available. Special "Feather Arts" slide lectures, presented by Phyllis Rabineau, curator-in-charge of Field Museum's current "Feather Arts" exhibit, are available in April. A visit to the exhibit follows. Reservations are required. Call 922-0733 for more information.

**Spring Journey.** "The Meaning of Feathers." Through May 31. Self-guided tour leads families and children through exhibits to discover what birds and their feathers mean to various cultures. Free *Journey* pamphlets are available at the North Information Booth, and at the South and West doors.

**Friend or Foe? The Natural History Game.** Field Museum's popular "Anthropology Game" has been expanded to include botany, geology, and zoology. The object here is to determine which one of a pair of apparently similar specimens is harmful and which is not. See if you can distinguish a vampire bat, a headhunter's axe, a poisonous mineral, or a deadly mushroom from its benign look-alike. Ground floor, no closing date.

**On Your Own at Field Museum.** Self-guided tour booklets, adult- and family-oriented, are available for 25¢ each at the entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p..

**Volunteer Opportunities.** Limited opportunities are available in botany, geology, and zoology. Weekend volunteers with an interest in natural history are needed to develop and present weekend programs. For more information call 922-9410, X 360.

**April and May Hours.** During April, the Museum is open daily 9 a.m. to 5 p.m. except Fridays. In May, the Museum is open every day 9 a.m. to 6 p.m. except Fridays. On Fridays, the Museum is open 9 a.m. to 9 p.m. throughout the year.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at the reception desk, main floor.

**Museum Telephone: (312) 922-9410**

May
1979

FIELD MUSEUM OF NATURAL HISTORY BULLETIN

# Members Nights'

May 2, 3, 4

**Field Museum of Natural History Bulletin**

May, 1979
Vol. 50, No. 5

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*Production:* **Oscar Anderson**
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*President and Director:* **E. Leland Webber**

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COVER

*A frolicking* shishi, *or lion-dog, is depicted on this 19th-century example of* inro, *a type of container used in Japan initially for carrying seals, and later for medicines. Worn exclusively by men, they also served as status symbols. Like the one shown here,* inro *were often made of lacquer and were exquisitely fashioned. This example, 9 cm. high, is executed in high relief using various elaborate gold lacquer techniques. Signed "Kajikawa" (a school of lacquer artists, 17th to 19th century), #255001. It is from a collection of remarkable lacquerwares recently donated to Field Museum by John Woodworth Leslie. These and other examples of Japanese lacquerware will be on view in Hall 32 beginning May 9. Photo by Ron Testa. See story pp. 12-19.*

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# FIELD BRIEFS

*John Witek, of International Harvester Company, slices through a Field Museum meteorite.*

### International Harvester Cuts Meteorites down to Size

Each year the Department of Geology receives requests from laboratories all over the world for the loan of meteorite specimens. These are used for a variety of experimental purposes and research measurements.

Depending on the specific requirements of the laboratory requesting a meteorite loan, samples are frequently produced by being cut from larger specimens. Samples of modest size can ordinarily be cut by the saws in the Department of Geology, but occasionally the piece required must come from a meteorite that is too large for our saws to handle. When this occurs the Museum has to call on outside help.

For the second time in a decade, the International Harvester Company, Manufacturing Research Division, of Hinsdale, Ill., has come to our aid in this matter. Their saws, capable of handling objects as large as tractor engine blocks, are ideally suited for slicing chunks from "oversize" meteorites.

Alex V. Peterson, the division's director of manufacturing research, recently took eight meteorites—the largest weighing 155 pounds—and had them sawed for us. Plant staff members Gordon Walters and John Witek were responsible for the project, Witek doing the actual cutting.

It was a problem, even for his heavy duty equipment, because of the odd sizes and shapes of the meteorites; they were difficult to clamp firmly into position. Nonetheless, the cutting was completed in a week's time. For years to come, smaller sections of these slices can be produced by the Museum's saws as requests for specific samples are received.

The Museum is grateful to International Harvester for the unique service they have most generously provided.

### Whitcomb Named to Anthropology Staff

Newly appointed as assistant curator of Middle Eastern archaeology and ethnology is Donald S. Whitcomb, most recently a research fellow at the Metropolitan Museum of Art. A major, initial responsibility of Whitcomb's will be a presentation of the exhibit "Treasures of Cyprus," opening June 14. In addition to cultures of the Middle East, Whitcomb's responsibilities will include Etruria and Rome.

Whitcomb received his B.A. from Emory University, his M.A. from the University of Georgia, and his Ph.D. from the University of Chicago. His dissertation was on "Trade and Tradition in Medieval Southern Iran." Together with his wife, Janet H. Johnson (associate professor at the University of Chicago), he has worked on an excavation at Quseir al-Qadim, an Egyptian port on the Red Sea, with Roman occupations in the 1st and 2nd centuries A.D. and Islamic occupations in the 13th and 14th centuries.

### Donald R. Fischer Named Chief, Security and Visitor Services

Field Museum's new chief of Security and Visitor Services is Donald R. Fischer. He succeeds Anthony DeBlase, who had held the post since 1971. A native Chicagoan, Fischer has returned to his home town after more than twenty years service with the U.S. Army Military Police Corps. His final military assignment was as Criminal Intelligence Coordinator in Hawaii.

Ron Testa

*Display case in new exhibit: "Feather Arts: Beauty, Wealth, and Spirit from Five Continents," on view until July 15 in Hall 26.*

### Museum Cohosts Carboniferous Congress in Urbana

Field Museum is a cosponsor of the technical sessions of the Ninth International Congress of Carboniferous Stratigraphy and Geology, to be held during the week of May 21 in Urbana, Illinois. This important congress, which meets every four years, last met in Moscow, in 1975.

Members of the Department of Geology who are taking an active role in this year's congress include Gordon C. Baird, assistant curator of fossil invertebrates; Eugene S. Richardson, curator of fossil invertebrates; Bertram G. Woodland, curator of petrology; and Rainer Zangerl, curator emeritus. These men will lead field trips to specimen collecting localities in Illinois and Indiana. Baird and Woodland are organizing a discussion group and will present research results at the technical sessions. An exhibit to be displayed at the congress is being developed by John Harris, preparator, and other members of the staff.

### Definitive Work Published On Fossils of Mazon Creek

*Mazon Creek Fossils* is the title of a 581-page work published in May by Academic Press, a subsidiary of Harcourt Brace Jovanovich. Editor of the work, consisting of eighteen technical papers is Matthew H. Nitecki, curator of fossil invertebrates. The papers were originally presented during a symposium held at Ann Arbor, Michigan, in May, 1978. Authors of the papers include six members of the Field Museum Geology staff and three Field Museum research associates.

The study of the fossils of Mazon Creek (some 50 miles southwest of Chicago) had its beginnings in the mid-1800s, when it first came to the attention of distinguished geologists James Dwight Dana and Edward Drinker Cope. Today Mazon Creek is recognized as one of the most important fossil beds in the world. The present volume is the most comprehensive work on the subject yet to appear.

The 18 essays are arranged in four groups: "Historical and Geological Papers" (4), "Paleobotanical Papers" (3), "Invertebrate Paleontology Papers" (8), and "Vertebrate Paleontology Papers" (3).

Contributions by Field Museum staff include "Mazon Creek Fauna and Flora: A Hundred Years of Investigation," by Matthew Nitecki; "Lithology and Fossil Distribution, Francis Creek Shale in Northeastern Illinois," by Gordon C. Baird; "The Occurrence and Origin of Siderite Concretions in the Francis Creek Shale (Pennsylvania) of Northeastern Illinois," coauthored by Bertram G. Woodland; "Polyplacophoran Molluscs of the Essex Fauna (Middle Pennsylvanian, Illinois)," coauthored by Eugene S. Richardson; "Middle Pennsylvanian (Desmoinesean) Cephalopoda of the Mazon Creek Fauna, Northeastern Illinois," coauthored by Richardson; "New Chondrichthyes from the Mazon Creek Fauna (Pennsylvanian) of Illinois," by Rainer Zangerl; and "*Amphibamus grandiceps* as a Juvenile Dissorophid: Evidence and Implications," by John Bolt.

Contributions by Field Museum research associates include "The Mazon Creek Biotas in the Context of a Carboniferous Faunal Continuum," by Frederick R. Schramm; "Evidence for Subaerial Activity of *Euproops danae* (Merostomata, Xiphosurida)," by Daniel C. Fisher; and "Fishes of the Mazon Creek Fauna," by David Bardack.

### New Exhibition: "The Art of Being Huichol"

This traveling exhibition of more than 150 objects of Huichol Indian art opens in Hall 27 on May 5. The exhibit was organized by the Fine Arts Museums of San Francisco and is sponsored by a grant from the National Endowment for the Arts and by the Museum Society of the Fine Arts Museums of San Francisco. The exhibit includes costumes, votive objects, weavings, embroidery, beadwork, and yarn "paintings."

The "art of being Huichol" is the act of living a devout life, and spiritual themes dominate the art of these people. The Huichol also value visionary experiences produced by the hallucinogenic peyote and these images are reflected in their dramatic yarn paintings. The Huichol live in an isolated area of western Mexico, and they remain one of the few traditional Indian groups whose ancient beliefs and practices remain unchanged even today. The exhibition closes September 3.

### Spring Systematics Symposium

On May 12 Field Museum will host its second annual Spring Systematics Symposium. The topic of this year's meeting is "Origins and Maintenance of Diversity."

David M. Raup, chairman of Field Museum's Department of Geology, will speak on "History of Phanerozoic Diversity." Other speakers include Sidney Anderson, American Museum of Natural History; Joseph H. Connell, University of California, Santa Barbara; Karen E. Loeblich, University of California, Davis; Howard L. Sanders, Woods Hole Oceanographic Institute; and Robert H. Whittaker, Cornell University.

### Museum Geologist Honored

Edward J. Olsen, curator of mineralogy, has been awarded The Distinguished Service Medal in Antarctic Research by the Office of Polar Programs of The National Science Foundation. The award is shared with two of his colleagues, William A. Cassidy of the University of Pittsburgh and William P. Glass of the University of Delaware. The award is in recognition of the innovation of the very successful meteorite recovery program on the ice cap in Antarctica. Olsen collected meteorites in the region in 1977.

# FIELD MUSEUM TOURS

## *Exclusive Tour Packages for Members and Their Families*

Very little time remains to sign up for Field Museum's tour of the Soviet Union; May 15 is the deadline for bookings. The tour, "Treasures of Russia and the Ukraine," leaves Chicago's O'Hare Airport June 19 and returns July 8.

Highlights of the tour, exclusively for Field Museum members and their families, will include visits to the cities of Moscow, Vladimir, Kiev, Leningrad, Petrovorets, Novgorod, and Petrozavodsk. The group, limited to 35 persons, will be led from Chicago by a Russian-speaking lecturer and a Russian-speaking escort, with additional guides while in the Soviet Union provided by *Intourist* (the Soviet Travel Bureau).

The tour cost—$2,970 (which includes a $500.00 donation to Field Museum)—is based upon double occupancy and includes round trip air fare from Chicago to Moscow, with intra-Russian air transportation where required. The transatlantic airline is Swissair.

Deluxe hotel accommodations will be used throughout or, where necessary, the best hotels available. The package includes all meals, including inflight meals; all sightseeing via deluxe motor coach; all admissions to special events and sites, where required; all baggage handling throughout, plus all necessary transfers; all applicable taxes and tips; all applicable visa fees. Advance deposit required: $250.00 per person.

For full itinerary, additional details, and registration information for all tours, please write or call Michael J. Flynn, Field Museum Tours, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.

## *Treasures of Russia and the Ukraine*

*Church of the Assumption, Moscow*

# Members' Nights

## Field Museum's Open House for Members

### May 2, 3, 4

Chicago's big social event for May will, without a doubt, be Members' Night at Field Museum. This, at least, is the opinion of the Museum staff, which is busy preparing a "feast" of unusual displays, "live" exhibits, demonstrations, and intellectual games for Museum Members. From 6 to 10 p.m., on three successive evenings—May 2, 3, and 4—Members will also see what goes on in the non-public areas: the laboratories, preparation rooms, collection storage areas (where more than 99 percent of the Museum's specimens are kept); they will also have an opportunity to chat with curators and other staff. Members will have the opportunity to see many building improvements that have been made in the past three years as part of the Museum's $25 million rehabilitation program. An additional attraction on these three nights is the chance to preview the new exhibit "The Art of Being Huichol"—an exciting display of more than 150 objects of Huichol Indian art.

All of this activity will, of course, be supplemented with food and drink, and the spacious grandeur of Stanley Field Hall will resound with live music.

As in the past, free round-trip charter bus service will be provided between the Loop and the Museum. These CTA busses, marked *FIELD MUSEUM*, will originate at the southwest corner of State and Jackson, with stops at the southwest corner of Michigan and Balbo. Two busses will be making continuous circuits, beginning at 5:45 and passing at about 15-minute intervals, until the Museum closes.

Plenty of free parking is available in Soldier Field lots and the Planetarium parking area, with a shuttle bus continuously circling the areas and collecting and discharging passengers at the Museum's south steps.

From 6 p.m. to 7 p.m. the Museum's food service area will provide complete dinners or snacks.

All Field Museum Members and their families are urged to come, and to reacquaint themselves with *their* Museum.

# The Remarkable Manatee

## *A Personal Adventure*

BY THOR JANSON

*Photos by the author*

*"On the previous day, when the admiral went to the Rio del Oro, he saw three mermaids which rose well out of the sea. . . . They were not as beautiful as they are painted though they had something of a human face."*
—From the ship's log of the *Santa Maria*, January 9, 1493.

Three months earlier, Christopher Columbus's tiny ship had first come upon the shores of the New World. Mariners, traditionally, have a special reputation for the spinning of tall tales. But in the case of Columbus's mermaids, we can believe that the account in his log had some basis in fact. Together with his discovery of the New World, Columbus had also come upon one of the Americas' most remarkable creatures, the manatee.

This aquatic mammal belongs to the order Sirenia, often described as the most endangered of all mammal groups. Along with the order Cetacea (whales and dolphins), the sirenians are the most at home in a watery environment, having no hind legs and being unable to move on land. We have evidence that the Sirenia were evolved in North Africa from the same stock that gave rise to the Proboscidea (elephants). Early forms have been discovered in Eocene deposits (55 to 65 million years old) in Egypt as well as in the West Indies. The presence of the manatee genus *Trichechus* along the eastern and western shores of the Atlantic and its avoidance of the open sea are considered further evidence that a continuous coastline once existed between Africa and America.

Sirenians are the only animals on earth in which we find classical pachiostosis, which means that all of their bones — like ivory — are very hard and dense. They are also unique among mammals as the only large aquatic herbivores. In size, adults range from eight to twelve feet at maturity and weigh between 800 and 1,500 pounds. Their bodies are fusiform, or torpedo-shaped, and their skin is very thick, not unlike an elephant's. This has a sparse growth of large hairs—about one per square inch of body surface.

There are three living manatee species: the African (*Trichechus senegalensis*), the Amazonian (*T. ininguis*), and the West Indian (*T. manatus*); and one species of dugong (*Dugong dugong*). The major difference between manatees and the dugong is in the tail: The dugong's is fluked, like a whale's, while the manatee's is round and rather spoon-shaped. The largest of the Sirenia of modern times was Steller's sea cow (*Hydromalis gigas*), which lived in the Bering Sea. This species was slaughtered into extinction in 1768, less than 30 years after being discovered.

Dugongs are listed in the *I.U.C.N. Red Data Book* as "vulnerable," in terms of threats to the species' survival. Their range is from eastern Africa to Australia, but their numbers are now much depleted in most of this area. The largest concentration appears to be along Australia's northwest coast.

The continued survival of the three manatee species appears to be in a much more critical state than that of the dugong. The *Red Data Book* describes the African manatee, which ranges along Africa's west coast from Senegal to Angola, as "seriously depleted throughout its range" and the Amazonian species as "in real danger of extinction."

The West Indian manatee is faring no better. It once flourished in coastal waters, rivers, and lagoons of the United States from as far north as North Carolina to southern Texas, the waters surrounding the Bahamas and Greater Antilles to the Yucatan, southern Mexico, and along the Atlantic shores of Central and South America to Brazil. Today, its occurrence in North America is limited almost exclusively to Florida, where a population estimated at 600 to 1,000 is actively protected.

Throughout Latin America the manatees have been aggressively hunted for their much prized meat and oil. In some cases, as with the Amazonian species, intensive commercial exploitation has brought them very near extinction. Where once they were commonly seen in groups of hundreds, even thousands, they are now so rare as to be virtually nonexistent. Only scattered enclaves along the South American coast continue to offer some refuge.

Before the Spanish conquest, the manatee was a familiar sight to the Mayan Indians of

*Thor Janson, supervisor of the Guatemalan Manatee Project, is on the faculty of the School of Biology, San Carlos University of Guatemala.*

*"In a quick movement, she pushed her nose upward, nudging my hand."*

Guatemala. Their high regard for this animal was not only because of its delicious meat, but because they believed it to have certain supernatural powers. The animal's earbone was worn as a talisman. The Mayans had a special process for drying manatee meat, the product being known as *buccan*. The name "buccaneer," according to one theory, was given to early freebooters and pirates who relied on *buccan* as a food staple.

One of the earliest references to the New World manatee was that of the Spanish explorer Fuentes y Guzman, who wrote in 1700 that "not only in Lake Izabal and the Rio Dulce, but along the entire coast from Mexico to Nicaragua they are caught in huge quantities during the whole year." In the encyclopedia *Biologia Centrali Americana* (London 1882) we already find concern over the declining manatee population. The encyclopedia's article on the manatee notes that Lake Izabal was a primary reservoir for the species but doubt is expressed concerning its prospects for survival; hunting had already made serious inroads into the lake's manatee population.

In the late 1930s, Field Museum zoologist C. M. Barber spent several weeks on Lake Izabal collecting manatees. He described large herds that could easily be approached by canoe, but he often experienced days when none could be seen. Observed Barber: "It will be interesting to hear the facts someday from some competent field naturalist who is not too busy accumulating specimens so that he may spend the necessary time (to study the habits of the manatee). Let us hope that the manatee is not extinct before that day comes."

At the same time that they were declining in Guatemala, manatees were becoming all but nonexistent along much of the Mexican and Central American coast. In some areas the animals had apparently begun to alter their behavior patterns — adaptations which have no doubt helped them avoid being wiped out. Their only defense against this fate was concealment. No longer would herds of manatee be seen grazing lazily, surfacing at frequent intervals, like dolphins. In 1935 zoologist O. W. Barrett wrote that the manatee of the Indio River of southern Nicaragua were largely nocturnal and particularly surreptitious, seldom being found in groups.

Their continued survival in some waters might well be attributable to this change of habit. Hunters of manatee now had to stalk them for hours and days at a time, and in most areas great skill was required just to locate them. The hunter learned to be absolutely silent, knowing that the slightest noise could "spook" a manatee hundreds of meters away. Hunters came to Lake Izabal even from Honduras, hoping to bring home a supply of fresh manatee meat, described by a contemporary writer as "the most delicious flesh in the world, . . . its parts having no less than seven different and distinct flavors."

Until very recently, manatees in Lake Izabal were most populous along the lake's western end, by the mouths of two large rivers, the Rio Polochic and Rio Oscuro. Heavy silting and frequent inundation of adjacent land had created there a swamp interlaced with small canals, not unlike those of the Florida Everglades. Among lush growth of grasses and water lilies the

*(Continued on p. 28)*

**FIELD MUSEUM TOURS**

# COOK ISLANDS

THE UNIQUE OPPORTUNITY to see a hidden corner of the fabled South Seas awaits a select group of Field Museum Members. Accompanied by three staff scientists, from July 14 to 31, a visit to the Cook Islands will involve comfortable living in a still-unspoiled paradise. It will be the dry season, with clear lagoon waters, sunshine guaranteed, and comfortable temperatures.

Located between Tahiti and Fiji, the Cook Islands offer one of the last relatively unspoiled island areas. Rarotanga, with towering peaks and narrow valleys, is surrounded by a reef and coral islets. A new 150-room hotel provides a base with modern comforts. Aitutaki, an hour away by small plane, is a classic atoll lagoon, rich in marine life and superb for snorkeling or SCUBA diving. There, a comfortable, country-style hotel will provide two nights' accommodation right next to a lagoon reef, with the simple, friendly services of the Polynesian community. Mangaia, also a short flight away, will be visited for a day, with an inland hike and a journey to the lagoon areas. The last three days of the tour will be spent in Hawaii.

The tour's scientific lecturer/escorts will be Dr. Alan Solem, curator of invertebrates, Dr. Robert K. Johnson, associate curator of fishes, and Dr. Elizabeth L. Girardi, research associate in invertebrates. Dr. Solem has participated in many expeditions to this part of the globe and has written extensively on its fauna. Dr. Johnson, a certified SCUBA diver and expert on coral reef fishes, has participated in many diving expeditions to both the South Pacific and the Caribbean. Dr. Girardi has also made many collecting trips to the South Pacific, concentrating on marine invertebrates.

The tour, limited to 25 persons, will travel via Air New Zealand. The tour cost—$2,650 (includes a $400 donation to Field Museum)—is based upon double occupancy and includes round trip air fare to and from Chicago. Also included is all inter-island transportation, all meals (except lunches in Hawaii) and all inflight meals, all admissions to special events, where required; all baggage handling, plus all transfers, all applicable taxes and tips. Advance deposit required: $400 per person.

For full itinerary and other information, write or call Michael J. Flynn, Field Museum Tours, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.

*Tour members will stay at the Rarotangan, the Cook Islands' new luxury hotel.*

Air New Zealand

# FIELD MUSEUM TOURS

## *Exclusive Tour Packages for Members and Their Families*

*Fabulous Machu Picchu, one of the sites to be visited on Field Museum's Peru tour.*

# PERU

IN 1978 FIELD MUSEUM was host to a dazzling exhibit of golden treasures from ancient Peru. Now Field Museum members and their families can visit some of the archeological sites where those treasures were discovered. A 20-day tour (Oct. 27-Nov. 15) will visit the famed ruins of Machu Picchu, Chan Chan, Pachacamac, Purgatario, and others. Also on the itinerary are the Plains of Nazca (viewed from low-flying aircraft), the offshore Guano Islands, and the famous Pisac Indian Fair. The group, limited to 20 persons, will be led by Dr. Michael Moseley, associate curator of middle and South American archeology and ethnology, and by Robert Feldman, assistant in archeology. Both Moseley and Feldman have done extensive archeological work in Peru; a tour escort will also accompany the group.

The tour cost—$2,998 (which includes a $500 donation to Field Museum)—is based upon double occupancy and includes round trip air fare between Chicago and Peru, as well as local flights in Peru. Delta Airlines will be used between Miami and Chicago, connecting with Aeroperu.

Deluxe hotel accommodations will be used throughout. The package includes all meals, including inflight meals; all sightseeing via deluxe motor coach; all admissions to special events and sites, where required; all baggage handling throughout, plus all necessary transfers; all applicable taxes and tips; all applicable visa fees. Advance deposit required: $250.00 per person.

For full itinerary and other information, write or call Michael J. Flynn, Field Museum Tours, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.

1. *Young man with ox under pine tree, in gold lacquer on a black ground. Signed "Koma Kansai" (early 19th c.). Height 6.2 cm. #255068.*

# INRO AS ART

## *Notes on a Japanese Lacquer Exhibition*

BY CAROLYN MOORE, BENNET BRONSON, MARY BARRETT, AND DIANE ZORICH

PHOTOS BY RON TESTA

THE LACQUERWARE OF JAPAN has long been famous. It is tough, brilliant in design, luxurious to the eye, and profoundly appealing to almost everyone. Yet on the whole it has been surprisingly neglected by Western museums and students of art. Perhaps because of prejudice in favor of "fine arts" such as sculpture and painting, or perhaps just because they have not seen enough of it, the majority dismiss Japanese lacquer as splendid but trivial. Recently, however, a minority has begun to take the subject more seriously. Lacquerwares are seen as important cultural documents and also as art, often of very considerable merit. Extremists have even claimed that certain lacquer pieces are "the most perfect objects ever to have come from the hand of man."

On May 9, Field Museum will open an exhibition that may help viewers decide these issues for themselves. Entitled *Inro, Shrines, and Netsuke: the Art Lacquer of Japan*, the exhibition comprises some 350 objects that have been donated or loaned to the Museum within the past year: 100 lacquer *inro* with accompanying *netsuke* and *ojime* beads, 25 miniature lacquer shrines, and about 25 lacquer boxes, trays, bowls, and so forth. The bulk of these come from the remarkable collection of lacquerwares recently donated by John Woodworth Leslie; in addition, 35 fine *inro* sets have been loaned for the exhibition by another noted Chicago-area collector. A number of objects have also been drawn from the comprehensive Japanese collection donated to Field Museum last year by Mr. and Mrs. G. E. Boone. Quite by chance, the generosity of these Japan-specialized collectors coincided with the Museum's decision to participate in a city-wide festival of Japanese culture, *Japan Today*, scheduled to begin April 26. The Museum was thus given both means and motive to install its first Japanese exhibition in 50 years.

Oriental lacquer (which should not be confused with the shiny paints known by that name in Western countries) is technically the resinous sap of several small trees and thick vines native to China and Japan but closely related to North American poison ivy and poison sumac. Like those plants, raw lacquer contains a contact poison that causes severe dermatitis. The nonpoisonous finished lacquerware is made by applying numerous coats of the purified resin over a very thin base of wood or other material and letting these harden slowly, each for several weeks or months, in a moisture-laden atmosphere. Interestingly, lacquer will not harden at all under dry conditions. Once "dry," the resin forms a natural polymer that is highly resistant to chemical and biological damage. Only extreme dryness harms it; otherwise it is as nondegradeable as most modern plastics.

This paradoxical combination of durability and delicacy of appearance explains why lacquerwares have been popular in the Orient since ancient times and why they are quite often found at archeological sites in China, Korea, and Japan. The finds from China are the oldest. They go back more than 2,500 years, showing that (as Chinese and Japanese traditions have always maintained) it was the Chinese who invented the lacquer-making process. Local manufacture of lacquerware may not have begun in Japan until the seventh

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*Carolyn Moore is a volunteer in the Department of Anthropology and a long-term student of Japanese lacquers. Bennet Bronson is associate curator of Asian archeology and ethnology. Mary Barrett, of the University of Pennsylvania, and Diane Zorich, of Loyola University, are student interns in the Department of Anthropology.*

century A.D. However, once begun—as has happened in several other cases of foreign technology imported into Japan—the Japanese rapidly made up for lost time. By the twelfth century, Japanese lacquer workers could already teach their Chinese counterparts as much as they learned from them. By the early thirteenth century, the lacquerwares of Japan were unsurpassed, even in Chinese eyes. The later Tokugawa or Edo Period, between 1600 and 1850, became the last Golden Age of lacquer work.

It was an age of gold literally as well as figuratively, for gold was the dominant color on lacquer of the period: gold on translucent black; gold inlaid with iridescent shell; gold dust mixed with other metals and mineral pigments; gold of many forms and shades inlaid into, sprinkled and mounded on, and cut down into golden surfaces, all by semisecret techniques known to the connoisseur by a bewildering variety of names. To be sure, decorative methods were used that might require no use of gold at all—for instance, the plain wood surfaces shown in figures 7 and 8, or the deep-relief effects seen in figures 2 and 3. But almost always, at least a little gold was present. It was the hallmark of a luxurious age.

The most typical expressions of Tokugawa lacquer work are the small sectional cases known as *inro*, of which 26 (all from the Leslie Collection) have been chosen for illustrations here. The original *inro* seem to have been utilitarian containers for medicines, seals, or aromatic herbs, worn hanging by a cord from the belt and kept from slipping by an *ojime* bead and a *netsuke* at the cord's other end. *Inro* soon lost this purely practical function, however. With the exception of pipe and tobacco cases, they were the only costume accessory worn by men in a society where jewelry and other adornment were not customary but where wealth was great and social competition intense. *Inro* therefore almost inevitably turned into important status symbols.

The Tokugawa *shoguns* deliberately encouraged luxurious living by members of the old *samurai* aristocracy and at the same time permitted the rise of a newly prosperous urban merchant class. The result was an unprecedented demand for *inro*, to which the lacquer artists responded with a last great surge of creativity. Older techniques were perfected and many new ones developed. Designs reached new heights of technical finish and—naturally—of cost. Certain Tokugawa *inro* are among the best of all lacquerware and possibly the finest of any of the world's miniature art forms.

Whether the most technically perfect are necessarily the most beautiful is a matter of taste. Many modern enthusiasts, Japanese and American alike, tend to prefer *inro* with simple, understated designs—like those we see in figures 5 and 24—to such wildly ornate "bourgeois" productions as the one shown on the *Bulletin* cover. But, as careful examination of the next few pages will reveal, even the gaudiest pieces may show great power and subtlety as well as an experimental, even daring, approach to problems of design. Motifs may be drawn from mythology, from other arts like landscape painting, print-making, and weaving, or from direct, often humorous, observation of everyday life. All are adapted to the constricted curving surface of the *inro* with impressive skill. Looking at a photograph, one easily forgets that the piece in question is only a few inches high.

*Inro* passed out of use with the introduction of Western styles of dress in the mid-nineteenth century and continued to be made for only a few years after that. At the present day, lacquer arts of all sorts are in serious decline. The surviving traditionally trained masters are said to have few successors, and they themselves have been but a handful during the past fifty years or so. Very little good lacquer has in fact been made since the end of the nineteenth century, and this leads to a conclusion of interest to collectors and curators: Japanese lacquer, almost alone among the world's artistic media, is now essentially unfakeable. The skills are so rare and the traditional processes so time-consuming that a plausible fake would be prohibitively expensive, while a forgery made by non-traditional processes would hardly fool an alert ten year-old. □

Opening an Inro. *Although most* inro *are constructed like the two on the lower left, many other arrangements of the component parts are possible. All* inro *are designed to hang from a cord that passes through an* ojime *bead and is tied to a* netsuke *at the other end.*

**2.** *Dragon and waves, executed in high relief on carved vermilion lacquer—a Chinese-originated technique called* tsuishu. *Unsigned. Height 9 cm. #255021.*

**3.** *100 different forms of the word* ju, *"longevity," excised from thick black lacquer in* tsuikoku *technique. Unsigned. Height 7.7 cm. #254995.*

**4.** *Female court figure holding peony, carved with gold lacquer techniques in high and low relief against a rust and brown ground. Signed "Kajikawa" (early 19th c.). Unusually large—height 13.9 cm. #255031.*

**5.** *Design of 3 birds, in flat gold and silver lacquer on a translucent copper-red ground. Signed "Jushu" (early 19th c.). Height 7.8 cm. #254984.*

6. *Design of bamboo carved in high relief with leaves in gold lacquer. Signed "Shoto" (18th-early 19th c.). Height 8.2 cm. #255009.*

7. *Herringbone-patterned wood* inro *with gold lacquer shells showing design of a court hat, or* kanmuri, *framed by clouds. Signed "Shogyokusai" (early 19th c.). Height 8.7 cm. #254925.*

8. *Carved wooden turtle with many details, covered by thin layer of transparent lacquer. Signed "Sui" (date unknown). Height 8.5 cm. #254916.*

9. *Okame, a mythological figure, admiring flowering chrysanthemums. Executed in clear lacquer on cedar, with gold and silver lacquer details on a brown ground. Signed "Yoyusai" (1772-1845). Height 8.3 cm. #255077.*

**10.** *Young woman playing with children performing a* shishima'i *New Year's dance; in pearl shell, silver, ivory, and gold applied on a gold lacquer ground. Signed "Nakayama" (of the Shibayama school, probably early 19th c.). Height 11 cm. #254937.*

**11.** *Plum blossom in pearl shell and glass with gold lacquer leaves on a black ground enriched with squares of cut gold. Signed "Sakahisa" (date uncertain). Height 10 cm. #255096.*

**12.** *Toy peddler blowing bubble for attentive child. Executed in coral, pearl shell, and other stones, on a gold* fundame *ground. Signed "Nakayama" (probably early 19th c.). Height 9.5 cm. #255023.*

**13.** *Daikoku, a mythological guardian figure, scattering beans to chase away demons. Gold and silver lacquer detailing inlay of abalone shell. Height 9.2 cm. #255015.*

14. *Various species of insects, in gold lacquer and shell inlaid on a black lacquer ground. Signed "Koma Bunsai" (late 18th-early 19th c.). Height 6.5 cm. #254992.*

15. *A series of floral designs, in sections that exhibit various types of* nashiji *(gold flake-ornamented) grounds. Unsigned. Height 9 cm. #255058.*

16. *Outline in form of a* samurai *in full battle dress, executed in several gold lacquer techniques and with pearl- and abalone-shell inlay, all over a brown lacquer ground. Signed "Yamada Joka" (a 17th century artist, this* inro *is later). Very large, with height of 15.5 cm. #254956.*

17. *Entrance to a shrine as described in the* Tale of Genji, *in relief lacquer ornamented with colored lacquer and cut gold leaf. Unsigned. Height 9.2 cm. #255086.*

**18.** *An* oni, *a type of demon, poised to attack. Executed in relief with gold and various colored lacquers. Signed "Kajikawa" (probably early 19th c.). Height 8 cm. #254962.*

**19.** *A hanging vine with leaves and gourds, signifying autumn. The black ground is complexly textured, with the gold and silver plant motifs in low relief. Signed "Chikakusai" (date unknown). Height 8 cm. #254919.*

**20.** *Jurojin, the god of longevity, seated on a deer. In* shibuichi *metal alloy applied on low-relief lacquer. Signed "Tei Sai" (date unknown). Height 10.8 cm. #255061.*

**21.** Inro *in the shape of a Buddhist prayer gong, with panels of fish scales and confronting dragon-fish as the handle. In gold and red lacquer. Unsigned. Height 6.1 cm. #255025.*

**22.** *Design from a Japanese print: lady with parasol. The raised panel is framed with a mosaic of large gold flakes. Signed "Kajikawa" (probably early 19th c.). Height 9 cm. #254978.*

**23.** *Owl perching on a crooked maple branch. In cut gold-enriched relief against a brown* mokume *ground simulating wood or tree bark. Signed "Jitokusai Gyokuzan" (18th c.). Height 7 cm. #254981.*

**24.** *A design of two birds on a fruiting persimmon branch, in gold, silver and colored lacquer relief on a red-brown ground. Unsigned, possibly 18th c. Height 6.8 cm. #254974.*

**25.** *A coiled snake poised to strike at a frog on the other side of the* inro. *High relief in gold and colored lacquers on a green ground. Signed "Jokasai" (17th c., the* inro *is much later). Height 6.9 cm. #255074.*

# What's in a (Rock) Name?

## The names of rocks continue to be the bugbear of geologists and rock hounds alike.

*BY* EDWARD OLSEN

It seems only logical that any of us interested in the natural world should want to learn the names of the creatures and objects that make up that world. Of course, it's understood that the creatures and inanimate objects of nature have no names in themselves — we are only learning names that other men have assigned them. No one knows, for example, what a robin calls itself, or if red trillium has any sense of its own identity. Nevertheless, there is a real feeling of satisfaction in being able to recognize, by name, some natural creature or object. It gives us a sense of belonging, a bond with others who enjoy the same things, and, in recounting to others our joys in natural settings, we can communicate complicated descriptions in a few simple words.

More and more people are getting into natural history as a hobby. Each one seeks help in learning through a number of avenues: field guide books, taking courses, and joining clubs with others of similar interests. For most of these hobbyists there is pretty good help. Peterson's classic *Field Guide to the Birds of Eastern North America,* for example, requires little skill to use. You spot your birds, riffle through the pages of color plates until you get a match, and there you have it — a sense of real accomplishment. You read the basic description of the bird, its habits and habitat, and you've made a friend for life.

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*Edward Olsen is curator of mineralogy.*

*PHOTOS BY RON TESTA*

*A group of crystals of the mineral quartz, from arkansas (about half life-size). Quartz is a very common mineral in the earth's crust — a constituent of many rock types. Crystals of this size and quality, however, are rare. Most occurrences are colorless (as here), but quartz also may be purple, violet, pink, yellow, amber, or black.*

*This is a radiating cluster of gypsum crystals (life-size) from Australia. Gypsum is widespread, ranging in crystal size from huge prisms six feet long down to dust-size grains. It is mostly colorless, but may be tan or amber in color.*

If you are a wild flower freak you have a bit hairier row to hoe. Plants come in more varied forms than birds, so you'll probably have to spend some time learning how to use a key to identification. You'll have more initial frustrations, but gradually a sense of familiarity will creep in as you successfully identify the first few dozen spring and summer wildflowers in your area. With their shapes and structures as a basis, each newly encountered species becomes a bit easier — just like learning a new language.

So it goes, for those who are into all kinds of wild things: mosses, mushrooms, stars, mammals, fossils, snails, insects (especially butterflies), and on and on and on. The most benighted soul, however, in this whole scene is the poor fellow who decides that rock collecting is his thing. For him there is no avenue to the level of expertise enjoyed by his friend who might be deeply into bird watching. Although he may invest heavily in books — and half a dozen "new" ones enter the market each year — in hand lenses of different powers, reference kits, and may even join several organizations in the realm of mineralogy, he seems to be forever doomed to being unable to identify the objects of his affection — rocks.

At some stage he may decide that the cause of this is a cabal of professional geologists, who resent amateurs for some perverse reason, and have invented a methodology and terminology so complex as to exclude him. Alas, professionals wish the answer were so simple. If it were, you can be certain that long ago some pro, for the sake of the kinds of royalties that Roger Tory Peterson enjoys for his bird books, would break ranks and publish the definitive field guide to the rocks and minerals of the earth. He'd become a wealthy man. The fact that it hasn't happened yet is because it cannot be done. Let me explain.

Rock names are names given to objects that consist of a group of minerals. To start the process of naming a rock you have to be able to identify the minerals. What's a mineral? A mineral is a natural occurring (that is, not man-made or man-caused) chemical compound. To know even the simplest things about minerals you have to know a little something about chemistry — not a lot, but you must have some basic familiarity with chemical symbols and ideas. Right there, 95 percent of the amateurs are wiped out. Most people have never had any exposure to chemistry in school. Sure, one can always say that old time prospectors found minerals and didn't know any chemistry either. True, they also made lots and

*This is a 12-inch-long cluster of prisms of stibnite, the world's main ore of the element antimony. These beautiful, large crystals are from Japan, where they were once mined as ore. They are now collectors' items. Most stibnite occurs as tiny gray needles, or even as shapeless lumps.*

lots of mistakes. True stories abound of goof-ups made by chemically-innocent prospectors and miners — like the partners who mined out a few tens of thousands of dollars in gold, abandoned the mine, and left behind several millions in platinum on their waste heaps. We're trying for some level of understanding where we don't make too many simple errors — like our friend the bird-watcher who can spot a rare type of sparrow in the dim dusk just by the way it perches on a branch.

The next thing a mineral is, it's (usually) crystalline. Here the confusion for the beginner starts to compound. In his mind the word "crystal" can mean anything from the baubles on his rich aunt's chandelier, to the gift of glassware he gave his sister on the occasion of her wedding. Both are useless concepts in trying to understand the crystalline state. Again it has to do with chemistry, with atoms, and with three-dimensional geometry. Here's where the books come in.

There are dozens (perhaps hundreds) of books on the market that purport to lead you into mineral and rock identification. All these books are well-intentioned, and with varying degrees of sophistication. Some attempt, futilely, to explain concepts of chemistry and then plunge on to minerals and rocks. Others use chemical jargon without much explanation, leaving the uninitiated reader frustrated. Almost all of them make the same fatal error — they show pictures of perfect museum exhibit-quality crystals of the minerals they're describing — lovely colorful prisms with nice smooth crystal faces. One of the most common complaints of a collector is that, in the course of his collecting, he has never seen a sample of such-and-such a mineral that looks like the pictures in the books. Of course he hasn't. The books almost always illustrate the finest specimens that the writer can get his hands on. Artistically these photos please the writer and excite the potential collector (buyer), but the average collector is never likely to find such a specimen in a lifetime of looking.

The next big problem encountered by the reader and, before him, the author of such books, is how to describe the mineral in the text. Going back to our example of bird watching, let's imagine a bird book that gave the description of some common bird like this: "Rusty brown breast that may sometimes be blue, yellow, white, green, or red; back and wings often black, but may also be yellow, purple, brown, or pink; varies in size from 1/16 of an inch to 27 feet long; found on all continents, at all elevations, in all environments, at all times of the year"!

It is obvious that the characteristics described here are so inexact they are utterly confusing,if not entirely useless. Well, many minerals are like that. Let's take a very common mineral as an example, potassium feldspar. Depending on the atomic arrangements in the innards of this fellow, he can be called orthoclase, microcline, adularia, high sanidine, low sanidine, or amazonite. Only a small change in the chemistry — adding a pinch of sodium and withdrawing a pinch of potassium — and you can name it anorthoclase, perthite, or moonstone. The colors of any one of these can vary widely. Take microcline for example. I've seen it white, gray, pink, brown, dark red, green, and even black — same mineral! Take the size of the crystals. They range from pinhead-size specks found in most beach sands, all the way up to a single crystal mined out in Europe (it's used to make kitchen scrubbing cleansers, among other things) that was the size of a Chicago city bus. This mineral has no distinctive locale — it's found

everywhere in the earth's crust, in all ages of rocks, and in a large variety of rocks, from water-deposited sandstones to igneous, volcanic ash falls of the kind that buried Pompeii.

Now how are you going to put a clear, understandable description in a book that covers all that? You're not. You know what professionals do when they encounter it in the field? They avoid all those names entirely and call it "K-feldspar" (the K is the chemical symbol for potassium). There are, by the way, several other common minerals, as well as several less common minerals, that look pretty much like it, especially when the grain size is small. So even pros can, and do make errors for this common breed when they work with their eyes only.

What does the pro do when he's *got* to get some mineral right? He checks the more common ones under a polarizing microscope that can cost anywhere from $2,000 up to $30,000, depending on its versatility. Clearly, even the cheapest of these is beyond the pocketbook of most amateurs. For trickier minerals he may have to resort to x-ray methods, or even a huge device called an electron microprobe, the cheapest of which costs as much as a four-bedroom house.

Probably the best bet for the dedicated amateur is to sign up for a course in basic mineralogy at a local college evening extension division. Here, if it's well taught, he'll see more run-of-the-mill examples of the common minerals that make up the bulk of the rocks he's likely to encounter. He'll get to handle them, ask questions, and see a number of simple, affordable lab tools that can aid somewhat in identification of some minerals. With that under his belt he can then arm himself with a couple of the available books, being better able to interpret their descriptions and overly optimistic color plates.

Once he's got a grasp on some of the basic minerals he's on his way to identifying rocks. This is even trickier, if one can imagine that. Let's consider a common rock, one called granite. Granite has three basic ingredients: K-feldspar, quartz,

*Fluorite is the state mineral of Illinois. This specimen, however, is from England. The crystal group shown here is about 20 inches across. The violet-colored fluorite is embellished here with strings of small, white quartz crystals. Though commonly violet, fluorite is also found in purple, blue, white, yellow, green, or amber, or maybe colorless.*

and some ferromagnesian (I won't explain that) mineral like hornblende or biotite. Now these minerals have to be within a range of proportions, otherwise it's not called granite. If you have, for example, 30 percent quartz (by volume), 20 percent hornblende, and 50 percent K-feldsar, it's *granite*. In fact, if you've got 80 percent K-feldspar, 10 percent hornblende, and 10 percent quartz, it's still granite. But if the quartz content drops down to 4 percent, it's not granite — it's a *syenite*. If, however, the hornblende content gets as high as, say, 50 percent or 60 percent, you're going to find some geologists who'll call it an *amphibolite*. On top of this, names of our granite depend on the relative sizes of the mineral crystals in it, as well as on their relative proportions.

Let's suppose the rock is 50 percent K-feldspar, 30 percent quartz, and 20 percent hornblende. We just got through calling this granite in the above paragraph. But let's suppose the K-feldspar crystals are great big things — a couple of inches across, with hornblende and quartz grains of smaller dimensions. The rock is then called a *pegmatitic granite*. A pegmatitic granite must not be confused with a granite pegmatite, which is a somewhat more complicated creature (cannot explain that here). Now, let's suppose that instead of all this, our granite consists of those same minerals, smaller now (below a half inch), not just randomly packed together but with the hornblende lying in separated parallel layers alternating with quartz-feldspar bands. Then it's called a *granite gneiss* (pronounced "nice"). Now let's suppose the hornblende content is really low, say under a few percent, and the K-feldspar and quartz occur in grains of about equal size, and those grains are pretty tiny, around a sixteenth of an inch. Now the rock is called an *aplite*.

I can vary the proportions of just those three minerals and their relative grain sizes, and the geometry of their arrangements, and generate

*Malachite (green) and azurite (blue) from Bisbee, Arizona, where these minerals are mined as ores of copper. This specimen is about 8 inches long. Malachite and azurite, happily, only come in the colors shown here, which should make them easy to learn. Unfortunately, there are other minerals that occur with these same colors, often in the same localities.*

more names yet. But I'll stop here for this one — you either have gotten the idea by now or quit reading.

I think you can imagine how the horrors of names compound when you have a rock that consists of four or more mineral ingredients. You can also imagine the knitted eyebrows when you bring a chip of a rock to a museum geologist and ask him what it is. Let's suppose the rock was a granite in the first place, but when you bopped it with your hammer only a piece of a large K-feldspar grain broke off. You're going to be told you've got a single mineral, and it could be from any of a huge number of kinds of rocks because K-feldspar occurs in granites, pegmatitic granites, granite pegmatites, aplites, granite gneisses, syenites, granodiorites, quartz monzonites, monzonites, granophyres, granulites, arkoses, and on and on and on. Suppose, on the other hand, you only broke off a piece that had mostly hornblende. Your expert would call it an amphibolite. Well, you get the picture. No one would dream of bringing in a single bird feather to find out what the bird was, yet people bring in unrepresentative samples of rocks all the time. Worse yet, they may take different pieces to different experts and get different answers — concluding, of course, that the experts are real dummies.

Rock names are a mess. Yet no one has been able to come up with a better system. For the professionals, the names communicate, in a word or two, whole paragraphs of descriptive information. How do the pros handle this system? The same way that physicians handle all the masses of muscles, bones, nerves, tissues, etc. in your anatomy — they memorize it all. If they should get into some branch of geology where they seldom use most of the names, then they gradually forget them. I challenge any long-experienced marine geologist, geophysicist, geochemist, or petroleum geologist to define a *jacupirangite* or a *pseudoleucite tinguaite* for me!

Even those professionals — known as petrologists — who work with many rock types do not seriously attempt to make identifications by eye in the field. I once knew an experienced and canny field petrologist who spent years mapping a complex area of numerous rock types. He found that he could spot certain features of certain rocks by eye, well enough to use these distinctions as mapping units in order to be able to interpret the complicated sequence of igneous intrusions, metamorphic events, ore formation, and crustal folding and faulting. For years he just called them "A," "B," "C," and so on. He didn't give a hoot what the official names were. When he was finally collating and writing out his final report, each rock type was sent out for an expensive chemical analysis, which in combination with microscope study allowed him to assign an officially recognized name. He gave them names that would give the maximum information, in a few words, to other professionals. Alas, however, the report would be like classic Greek to an amateur.

The crust of the earth is highly varied, yet certain rock types are frequently seen: granite, gabbro, diabase, basalt, limestone, sandstone, shale. These names can be learned by an amateur, and he can learn to spot many of these in the course of his collecting. It is, however, not very satisfying to be able to know no more than eight or ten names. It's like knowing only a few common birds for a bird-watcher.

It's sad, but a rock collector will never be able to bootstrap himself into the kind of expertise that his friend the bird-watcher has achieved. No book will give him what a good field guide to birds, or wildflowers, or mosses, or et cetera, can give other natural history hobbyists.

The situation of naming rocks is not pleasing to the professionals either. Each one yearns for a better system. Through the early part of the twentieth century a dozen schemes were devised for giving useful and informative names to rocks. They all became either hopelessly complicated or impossible to apply without having expensive chemical analyses made of every rock collected. The present system is a patchwork compromise of all these competing systems.

Tom Barth (only recently deceased) was a superb petrologist — trained in Germany and Scandinavia — who worked with and studied the rocks that compose the earth's crust on all the continents of the world. In his book *Theoretical Petrology* he starts his first chapter, entitled simply "Rocks," with this paragraph:

"Rocks are made up of definite mineral assemblages. We may use an analogy from the zoological science and note that a mineral species will correspond to an animal species, whereas a rock corresponds to a fauna. It has become customary, and probably also necessary, to name the rocks according to their mineral content, taking into consideration the qualitative mineral content and relative proportions of the constituent minerals on the one hand, and the mechanical and textural relations on the other. In zoology this would mean that one had to introduce a special name for a fauna consisting of hares, foxes, fleas. Not only this; new names should be introduced as the relative proportions of these three animals were changed, and according to whether the hares are big and strong with silken fur or small and miserable from hunger and flea bites. Such analogies demonstrate how difficult it is to develop a satisfactory system of rock names, and explain why more than six hundred different rock names have been introduced (not counting compound names). They explain also why petrologists are helpless and, generally speaking, unhappy about it".

Amen.

# CHINA TOUR FOR MEMBERS

STANTON R COOK, courtesy *Chicago Tribune*

*Looking toward the slope of Wan Shou Shan, site of summer palace of the Chin dynasty, outside Peking*

PEKING'S FORBIDDEN CITY, the Summer Palace of the Dowager Empress, the bustling activity of Canton, the ancient pagodas of Kunming. These are just a sampling of the exciting sights that lie in store for the 23 persons (Field Museum members and their families) who will visit China on Field Museum's exclusive tour this November. The tour is for 21 days and goes by way of Europe.

The tour departs Chicago's O'Hare Airport November 5 and returns November 25. In addition to fourteen days in China, three days and two nights will be spent in London. The tour escort will be Mrs. Katharine Lee, a Field Museum volunteer in the Department of Anthropology who is fluent in five Chinese dialects. Additional guides in China will be provided by the China International Travel Service.

The tour cost—$4,400 (which includes a $500 donation to Field Museum)—is based upon double occupancy and includes round trip air fare from Chicago to China. The airlines used will be TWA, British Airways, and Air Ethiopia.

DELUXE HOTEL ACCOMMODATIONS will be used throughout or, where necessary, the best hotels available. The package includes all meals (except in London), including all inflight meals; all sightseeing via motor coach; all admissions to special events and sites, where required; all baggage handling throughout, plus all necessary transfers; all applicable taxes and tips; all applicable visa fees. Advance deposit required: $500.00 per person.

For full itinerary, additional details, and registration information, please write or call Michael J. Flynn, Field Museum Tours, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.

# PROJECT ANTARCTICA

## An exclusive for Field Museum Members and their families

*A 24-day cruise to Antarctica and the Falkland Islands on the* MS World Discoverer

*MS World Discoverer*

Until recently only explorers were able to view antarctica's wondrous beauty. There is no destination more remote, more unspoiled by the encroachments of civilization. Today only a virtual handful of adventurous travelers have experienced its majestic icebergs, extraordinary wildlife and fascinating natural history firsthand.

Our itinerary includes the Islas Malvinas (Falkland Islands) with its rich concentration of unusual wildlife, a visit to the Patagonian coast, and of course the antarctic peninsula with its spectacular scenery, fascinating wildlife, and international scientific stations. The South Georgia Islands and the South Orkney Islands will also be visited. Dr. Edward Olsen, curator of mineralogy and a veteran of antarctic exploration, will be on hand as tour lecturer. Join us for this outstanding travel adventure that will certainly be one of your most unusual and memorable journeys.

The cruise vessel will be the 3,200-ton tourist ship *M.S. World Discoverer*, which will take us from Punta Arenas onwards. Built in 1974, the one-class vessel has all outside cabins with private lavatories and showers. There is a fully qualified physician on board.

The tour leaves Chicago January 6, 1980 and returns January 30. Prices for the antarctica cruise per person: C deck twin: $3,230; C deck single: $4,870; B deck twin: $3,570; B deck single: $5,390; A deck, twin: $3,930. Air fare, in addition, is $1,225 (round trip between Chicago and Punta Arenas, Argentina). Included in the tour price is a tax-deductible donation of $500.00 to Field Museum. Deposit required at time of registration: $1,000.00.

For full itinerary, additional details, and registration information, please write or call Michael J. Flynn, Field Museum Tours, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605. Phone: (312) 922-9410. X-251.

*Village along the Rio Dulce*

MANATEES *con't from p. 9*

remaining manatees were able to find some refuge. For many years the area was considered the only good place to hunt manatees in the entire region. Today they are gone, and the general feeling among local fishermen is that the *vacas marinas*, or "sea cows," have been frightened off by a large refinery that was recently built along the lake's northwestern extremity. Whatever the reason for their disappearance, the animals have apparently learned that it is to their advantage to avoid man; they will rarely be observed near sites of human activity.

Fascinated by what I had heard and read of these remarkable creatures and appalled by the realization they could soon become extinct, I decided to do what I could to forestall that fate. The first step was to observe and study them in their natural habitat. I chose Guatemala for my study area because it is the only region where manatees are known to live in a freshwater lake. It also seemed likely that this relatively isolated body of water—Lake Izabal—and the Sweet River (Rio Dulce), connecting the lake with the Atlantic, might offer some potential as a permanent, established refuge.

I found encouragement at San Carlos University of Guatemala, where I was offered a situation as associate investigator with the university's school of biology. My first goal was to gather data on the population, distribution, and general ecology of the Guatemala manatee. This information could then be used in designing conservation and management programs. Since very few studies have been made of the manatee in its natural habitat, I also hoped to gather raw data that was new to science. I secured enough additional support to buy a small boat, an outboard motor, and a dugout canoe. A tent, camping equipment, a camera, and a notebook rounded out my basic needs for field work.

I was to find the manatees most numerous in lagoons and waterways along the northern edge of el Golfete, a widening of the Rio Dulce, and here I was most successful in observing them.

On April 1, 1977, while in my canoe, I entered the following in my notebook:

"5:00 a.m. As I watched, totally captivated, five forms slowly entered the lagoon. I was not seeing actual bodies, but fairly regular patterns of bubbles—three large arrays and two small ones. The formation entered very slowly and the fairly constant flow of bubbles gave the group the appearance of symmetry. The group reached the middle of the lagoon and paused, the larger bubbles in the lead followed at a distance by the smaller ones. Nothing happened for two or three minutes and I lost track of their position. Then at the other side of the lagoon I saw one large nose come above the surface of the water. Manatee! I watched them for more than half an hour. The small animals, infants or juveniles, surfaced for air more often than the adults and remained longer on the surface. I observed behavior that I could only describe as play: nudging, bumping and tail-nipping. This play was always between the two small ones or between the young and the adults. It was always the young inciting the play. They were very quiet. The only sounds I could hear were those made during their normal respiration and sometimes a spash. At about 5:45 the family (?) swam out of the lagoon, as slowly and as peacefully as they had come."

Of my many observations, the following—in which I made actual physical contact with the animals—is the most memorable. On November 8, 1977, I entered the following in my notebook:

"Upon awakening I looked over the side of my boat and saw evidence of two manatees grazing on the other side of the lagoon. Then one head broke the surface and looked over in my direction. During the morning the two edged closer and closer to the boat. One was a juvenile male about six feet long; the other, an adult female, measured about 11 feet.

"As I watched, I felt an unusually strong and persistent attraction towards them, a feeling I was not familiar with. I had the strongest, though unexplainable, impression that they were trying to communicate with me. I lowered my hand and lightly splashed the water. To my extreme surprise, the adult manatee, seeing this, came right up to the side of the boat and lifted her head above the water. I slowly lowered my hand until it was within an inch of her nose. In a quick movement she pushed her nose upward, nudging my hand, and disappeared back into the water.

"I could hardly believe what had happened, and felt a tingling sensation over my whole body. I put my hand back into the water and in a few seconds found myself stroking a big, soft, manatee nose. She would stay for a few moments and then go away, only to return again in a minute or two. This went on for quite some time, until I decided to see what would happen if I entered the water.

"I could not have been better received. The huge, but graceful, sirenian swam over to me and brushed up against my body. I rubbed her back. This she seemed to like very much. We swam together around the lagoon. I had begun to wonder what had happened to the young male, when I suddenly noticed him following at some distance. Eventually, he, too, came over and allowed physical contact. This interspecies meeting continued for most of the day, and the young manatee became increasingly playful. He would allow me to come just within reach and then would rocket away at full speed—which for a young manatee is about 12 to 15 miles per hour. At other times he would allow me to put my arms around the middle of his body and we would swim together. Unexpectedly, in a quick, jack-knifing movement, he would throw me off and swim around in circles. The older female was not interested in this sort of play, preferring to solicit my scratching and rubbing.

"Near dark, after grazing for a time on tender grass along the bank, my new friends swam over to me. I realized that they were about to leave. I can only say that I feel that a (special) bond . . . existed between us. I watched from the middle of the lagoon as they swam out of sight. This had been one of the most joyful days in my life."

I have not seen my manatee friends again and I am filled with sadness as I realize that little time remains in which to save them. As part of my program in Guatemala, I began to use all available channels to create public concern for the manatees' plight: the local press, magazine articles, radio programs, and materials for use in the public schools. I tried to impress government agencies with the need for conservation measures, and pointed out that the manatees could be useful in controlling water weeds. (Some waterways, once navigable, had become so badly choked with weeds that only the smallest canoes could now get through them. The so-called "English Channel," near Puerto Barrios, had formerly carried freight and passenger traffic; now, thanks to a heavy weed growth, the channel was completely useless for traffic.)

The Guatemalan government is currently designing a "master plan" for tourist development of Lake Izabal and Rio Dulce, and in connection with this I have attempted to point out that since tourists often have a strong interest in the local wildlife, it would be economically advantageous to also set up a program for the active protection of the manatee and other wildlife. The prospects for establishing sujch a refuge at el Golfete appear promising.

## *ILLINOIS ARCHEOLOGY FIELD TRIP*

For many of us, the word "archeology" conjures up visions of great architecture in distant places: Egypt's Pyramids and Sphinx, Cambodia's Angkor Wat, and Mexico's Pyramids of the Sun and Moon at Teotihuacan. These sites, with their relics, are limitlessly fascinating.

But right here in Illinois we also have exciting archeological sites, including the largest aboriginal structure north of Mexico—Monk's Mound at Cahokia. One of the most broadly based archeological research centers in the country is the Foundation for Illinois Archeology, at Kampsville; and one of the largest covered excavations with the longest continuing research programs is at Dickson Mounds, near Lewistown.

If you are interested in learning more about Illinois prehistory, as well as how scientific archeological research is conducted, you can join the Field Museum field trip of June 1-5, which will visit Dickson Mounds, Kampsville, and Cahokia Mounds. Limited to 30 participants, the trip includes site visits, lecture and slide presentations, workshops and discussions led by staff archeologists working at the respective sites. The field trip director is Robert Pickering, a doctoral candidate at Northwestern University.

The per person cost of this field trip is $240.00. For full details and registration information, write or call Michael J. Flynn, Field Museum Tours, Roosevelt Rd. at Lake Shore Drive, Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.

*Helton Mound, in the Lower Illinois River Valley, is typical of the sites to be visited during the June archeology field trip.*

# *Weekend Field Trips for Members*

## to

## Starved Rock, Illinois
## Galena, Illinois
## Baraboo, Wisconsin

*Historic Galena*

By popular demand, Field Museum's weekend trips to Starved Rock, Galena, and Baraboo are being offered again this year, with two weekends to choose from for the Galena and Baraboo trips.

**Starved Rock.** Dr. Gordon Baird, assistant curator of fossil invertebrates, will lead the group on the weekend of June 16-17 to Starved Rock State Park; Buffalo Rock State and Matthiessen State Park will also be toured. Eighty miles southwest of Chicago, Starved Rock is so named for a 125-foot-high sandstone outcrop, where a group of Illini Indians more than 200 years ago took refuge from another attacking tribe. The park is notable for its 19 canyons and their remarkable vistas. Tour members will stay at Starved Rock Lodge. Tour cost: $82.00.

**Baraboo.** Dr. Edward Olsen, curator of mineralogy, will lead tour members through the Baraboo range and along the shores and hinterland of beautiful Devil's Lake. Two tours are scheduled: May 19 and 20, and June 9 and 10.

The Baraboo Range is of special interest as a *monadnock*—what is left of an ancient mountain range and which now stands out above the younger rocks and sediments. The range consists of quartzite—more than one billion years old—which, although compressed in places into vertical folds, retains the original sedimentary structures. The mountains were further modified by glaciers, forming the lake and the picturesque glens, and changing the course of rivers.

Hiking clothes are strongly recommended for the scheduled hikes. The trip is not suitable for children, but younger people interested in natural history are welcome. The cost of the Baraboo trips is $70.00 per person.

**Galena.** Dr. Bertram G. Woodland, curator of petrology, will conduct two study tours through the geological area (once a lead-producing region) of this history-laden river town, which is built on rocky limestone bluffs. In addition to viewing geological features, tour members will have the opportunity to explore historic Galena's charming downtown area, with its unique variety of pre-Civil War architecture.

An overnight tour is offered for the weekend of May 5-6; per person: $98.00. A two-night, three-day tour is offered for October 12, 13, 14 at a rate of $150.00. Accommodations are at the Chestnut Mountain Lodge.

Rates quoted for all above tours are per person, double occupancy (single accommodations on request). Included are all expenses of transportation on charter buses and accommodations in first class resort hotels. The rate also includes all meals and gratuities, except personal extras such as alcoholic beverages and special food service. An advance deposit of $15.00 is required upon registration for each trip.

For additional information and reservations, call or write Michael J. Flynn, Field Museum Tours, Field Museum, Roosevelt Rd. at Lake Shore Dr., Chicago, Ill. 60605. Phone: 922-9410, X-251.

# OUR ENVIRONMENT

USDA—Soil Conservation Service

*Once hailed as a solution to many problems such as soil erosion, the kudzu is now regarded as a pest, covering hillsides, trees, telephone poles — even abandoned automobiles.*

### The Rapacious Kudzu

*Kudzu!* The very word has an alien, sinister sound. It conjures up the image of author Sax Rohmer's legendary villain, Dr. Fu Manchu, slipping a potion of deadly poison into the drink of an unsuspecting victim.

However, kudzu is *not* a potion. It is merely an exotic, leguminous vine with a broad, three-pointed leaf, and woody stem, first introduced to the United States from Japan in 1876 at the Philadelphia Centennial Exposition.

But what a vine! In a century, kudzu (*Pueraria lobata*) has virtually engulfed large parts of the South, spreading northward as far as central Kentucky, Virginia, and Maryland and westward into eastern Texas and Oklahoma. The region's long growing seasons, mild winters and abundant precipitation have enabled kudzu to grow—and spread—at phenomenal rates. The plant begins growing in the early spring with green tendrils radiating from its deep tap roots. Producing great quantities of foliage, the tendrils can grow 60 feet in a season, often climbing vertical obstacles as high as 40 feet. Allegedly, kudzu can shoot up as much as 12 inches in 24 hours!

By late summer, when the plant produces clusters of fragrant purple flowers, the ground is covered with a thick maze of vines, sometimes several feet deep. The plant then produces pods, but they seldom contain seeds in this country. But not to worry! Although kudzu loses its leaves after a killing frost and dies back to its root, the perennial vine regenerates each spring and continues to spread year after year as it establishes new tap roots at nodes along the stems. To make matters worse, the plant is bothered little, thus far at least, by disease or insects.

An estimated million acres or more of southern farm, forest, and pasture land are now covered by the spooky-looking growth. Little is safe from "attack." Fences, abandoned houses, unused railroad beds, junk cars, even telephone poles are quickly enshrouded. Predictably, that has led Southern folk—with wry humor—to tag kudzu with such descriptive nicknames as "mile-a-minute vine," "foot-a-night vine," or simply "the vine." With tongue in cheek farmers tell visitors, "When you plant kudzu, drop it and run!"

But how did this happen, you ask? Why didn't America's highly-respected agricultural scientists nip this viny, Oriental invader in the bud? Well, the truth of the matter is that these experts, for what was good reason at the time, actually aided and abetted the spread of kudzu—at least until the mid-1950s.

First used in the U.S. as an ornamental vine to shade porches of southern homes, kudzu—by the early 1900s—was found to provide inexpensive forage for livestock. Later, spanning the Great Depression years, kudzu's deep roots, dense foliage, and rapid growth, along with its nitrogen-fixing quality, provided the kind of ground cover needed to control gully erosion, stabilize road banks, and rejuvenate nitrogen-deficient soil.

In fact, southern farmers were so enthusiastic about kudzu that through World War II many communities formed "kudzu clubs" and elected "kudzu queens." Federal agencies gave away kudzu seedlings by the millions, and the Civilian Conservation Corps planted kudzu to help curb soil erosion. In those days the plant, now considered a pest, was called the "miracle vine." And for good reason. Experiments at the Soil Conservation Service's (SCS) Southern Piedmond Conservation Experiment Station at Watkinsville, GA, for example, showed that land planted to kudzu had nearly 80 percent less water runoff and more than 99 percent less soil loss than land under cotton.

The South's love affair with kudzu

didn't last, however, farmers found that kudzu, as forage, had serious drawbacks. It was easily overgrazed and much of the vine is woody stem, useless as hay. Further, it could be mowed for hay only once a year and still remain healthy. (In fact, overgrazing and too-frequent mowing are about the only ways of controlling kudzu's spread in pastures or cultivated fields, short of using chemical herbicides.)

Thus, as the serious soil erosion problems of the 1920-40s diminished, government agencies slowly became disenchanted with kudzu, especially as the vine continued to spread—and spread—and spread. In fact, by the mid-1950s state highway departments were employing chemical herbicides to eradicate kudzu stands along rights-of-way.

In 1953, the U.S. Department of Agriculture (USDA) removed the plant from the list of cover crops permissible under the Agricultural Conservation Program. In 1962 the SCS began limiting its recommendations of kudzu planting to areas widely separated from orchards, forests, fences, farm buildings, and other properties that could be overrun by the vine. The crowning blow came in 1970 when USDA finally listed kudzu as a common weed in the southern states!

True, some farmers still use kudzu as forage for livestock. However, the more affluent agriculturalist has turned to other, more productive feed crops such as bahia grass, coastal bermuda, and fescue despite the fact that such vegetation requires fertilizing and more of the farmer's attention.

Thus, although kudzu can still control soil erosion, stabilize soil, and grow well in nutrient-deficient soils, its aggressive growing behavior has become an overwhelming liability. Many tree farmers, orchard growers, woodlot owners, and the wood products industry are especially critical of kudzu's tendency to engulf all vegetation in its path. Trees both large and small, mature or sapling, are stifled and eventually killed.

So that is the story of kudzu. Once—not long ago—highly acclaimed, it has fallen into disrepute. No longer do southern towns stage "kudzu festivals" or elect "kudzu queens." Like water hyacinth and other exotic (introduced) plants which eventually proved to do more harm than good, kudzu is a pest. Its almost uncanny ability to grow and spread under the most adverse conditions—the very characteristic that once made it so popular, especially in reducing sedimentation and controlling soil erosion—now poses a problem for the South.

Unfortunately, the vine has spread so widely throughout the South that only a massive eradication effort involving, among other things, extensive use of chemical agents, could be effective. However, the great economic and environmental costs associated with such a campaign make its undertaking highly unlikely.

Interestingly, kudzu is still considered a useful plant in China and Japan. The Chinese, for example, greatly value the plant's root, which contains a starch used in making a popular kind of flour. Also, the ancient Chinese revered the plant for its alleged medicinal values. It was used apparently to treat such ailments as influenza, dysentery, and snake bite!

The resourceful Japanese, who permit kudzu to grow wild on steep, uncultivated slopes, use the entire plant. Besides making hay from the leaves and using them as forage, the Japanese make a coarse cloth from the stem and derive a starch from the root. The starch is then used in making noodles and candy.

Thus, although unlikely, it's possible that American researchers, too, will identify new uses for kudzu. It remains effective in stabilizing steep road cuts and stream banks, partly because of the plant's deep roots. Because of the vine's ability to grow in poor soil, it is also useful in revegetating denuded strip-mined areas. But each of these uses also depends on that same characteristic of kudzu that resulted in its classification as a pest plant in the first place—the vine's rate of growth!

Is it difficult to locate "the vine" as you drive through the South? Hardly. During the growing season, it would be almost impossible to miss the many distinctive patches of leafy vines blanketing road banks, covering road fields and shrouding trees beside the region's highways. But if you stop along the road to examine the plant more closely, watch out! Don't get too close or tarry too long or you might get more wrapped up in kudzu than you intended!—*Ken Hampton, National Wildlife Federation.*

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### No Longer a Wilderness Of Monkeys

The world's primates are in trouble. As a species, *Homo sapiens* appear to be one of the few primates with a relatively secure future. The reasons for concern are varied but they generally all stem from human actions.

Of the 166 species of primates living today, nearly a third are considered endangered. Primates are subject to a wider variety of population pressures than any other mammals. Not only do they have to cope with the severe problem of habitat loss, but they are also subjected to subsistence hunting for food, trapping for zoos and medical research, and for sale as pets. Primates, as other large advanced mammals, are slow to mature and breed, resulting in slow recovery of depleted wild populations.

The most serious problem confronting the world's primates is loss of their habitat to development, heightening the severity of the previously mentioned factors. Zoologist Jaclyn Wolfheim states, "The destruction of habitat overshadows all other proximate factors that influence the survival of primate populations. No degree of adaptability or regulation of trade in animals can save a species if all of its habitat has been bombed with napalm, razed by bulldozers or planted in soybeans. Conversely it is difficult to hunt a species to extinction if its original habitat is left intact."

The above quote especially applies to the prosimians, one of two suborders of primates, that includes lemurs, indrises, lorises, tarsiers, and the aye-aye. Prosimians, which have never been in demand for pets, food, or research, have experienced radical population declines almost exclusively in response to their loss of habitat. They are strictly Old World species living on the island of Madagascar and in some parts of Africa and Southeast Asia. This geographical restriction, their high degree of specialization, and their dependence on trees has been their downfall.

Lemurs, indrises, and the aye-aye, all limited to Madagascar and to the nearby Comoro Islands, have lost the trees upon which they depend for food and shelter (85 percent of Madagascar has been deforested). Exotic introductions have edged out Madagascar's prosimians, unable to compete with other mammals because the island's isolation prevented adaptations to selective pressures.

Mainland prosimians, such as tarsiers and lorises, have better succeeded in adapting to changing habits, perhaps because they have been subjected to a wider variety of pressures throughout their development.

The future of the anthropoids, the other primate suborder, is closely linked to the fate of tropical forests in Africa, South America, and Asia. Anthropoid species, including the marmoset, monkey, ape, and human families, are considered more flexible than the prosimians; they have adapted to changing environments and their habitats are not as restricted.

But the world's tropical forests are currently under an alarming seige by developers to provide charcoal, lumber, and agricultural land in Third World nations to promote rapid economic expansion. Gibbons, gorillas, orangutans, marmosets, and many monkey species are losing the large tracts of forest they need to

live. Habitat deforestation has placed three marmoset species under extreme pressure throughout their restricted range in Brazil. Several agricultural development schemes threaten the remaining habitat of the golden lion marmoset (*Leontopithecus rosalia rosalia*), the most acutely endangered subspecies. Negotiations are underway to try to preserve an adequate portion of this dwindling habitat for the 400 golden lion marmosets remaining in the wild. This subspecies breeds well in captivity, and reintroductions will be conducted as soon as suitable areas are identified.

### The Research Controversy

The use of anthropoid primates in medical research has long been a point of controversy among conservationists, medical researchers and humane activists. Primates, closer to humans phylogenetically than any other animal, are very well suited for research in a variety of physiological, morphological, and behavioral studies. For some pathological and neurological research no alternatives exist.

The chimpanzee (*Pan troglodytes*) is the only animal other than humans that is susceptible to hepatitis B, making it invaluable for vaccine development and testing. The U.S. Center for Disease Control in Atlanta estimates an incidence of 150,000 cases of hepatitis B for 1976, of which 1,500 were fatal. Chimpanzees are also the only animal model available for research on non-A, non-B hepatitis which is responsible for more than 80 percent of the post-transfusion hepatitis diagnosed in the U.S. Chimps are also important in research on other infectious diseases such as malaria, gonorrhea, and trypanosomiasis.

Two macaque species, the rhesus macaque (*Macaca mulatta*) and the long-tailed macaque (*Macaca fasicularis*), have long been the most popular general purpose primates for experimental use. The rhesus macaque has been the most widely used primate for the safety testing of poliomyelitis and other vaccines. It was also used in the discovery of the Rh factor, an indicator of a blood disorder that can affect the developing human fetus. Baboons (*Papio spp.*) are also important as research models particularly in the areas of surgical technique development and neurophysiology.

### Tougher To Get

Several recent developments have caused heated debates among factions interested in the use and supply of experimental primates. Continued population declines of chimpanzees, rhesus macaques, and other primate species have led to reevaluation of the use of these primates and of their capture methods. In April, 1978 India banned the export of rhesus macaques, citing severe population declines and the violation of an agreement with the U.S. that rhesus macaques would not be used for research involving nuclear arms. Suddenly the U.S. was left without a supplier of its most heavily used primate. It was hoped that Bangladesh would be able to supply some macaques, but for various reasons this has not been the case. Since captive stocks are limited, many researchers are attempting to replace the rhesus with long-tailed macaques but are finding these in short supply also.

A major U.S. pharmaceutical company wants to purchase 125 chimpanzees from suppliers in Sierra Leone, in western Africa. Trade in primates is regulated by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) requiring permits for the importing company from the importing and/or exporting nation. So far the U.S. Fish and Wildlife Service's Wildlife Permit Office has refused the permit on the basis that not enough information is available on Sierra Leone's chimp population and also that unsound collection methods would be used.

A major point of contention in this permit application and in wild primate collection in general is the common methods of capture. Wild primates, given their agility, intelligence, and their often rugged habitat, are difficult to capture. Often they are trapped in snares and nets, resulting in the deaths of numerous animals. Sometimes the mother is killed to capture the young. Since most primates bear and raise only one or two of the young at a time, many adults may be killed to fill an order.

One possible solution to the supply problem is development of captive breeding programs. So far, the success of these programs has been limited, primarily because they have not been encouraged. Until recently, the supply of wild primates was adequate, and they were less expensive than captive bred primates. A captive bred chimp, for example, may cost $5,000 to $10,000. Its wild counterpart may run less than half that amount. Also, researchers are only beginning to learn about primate social behavior, a prime determinant of breeding success.

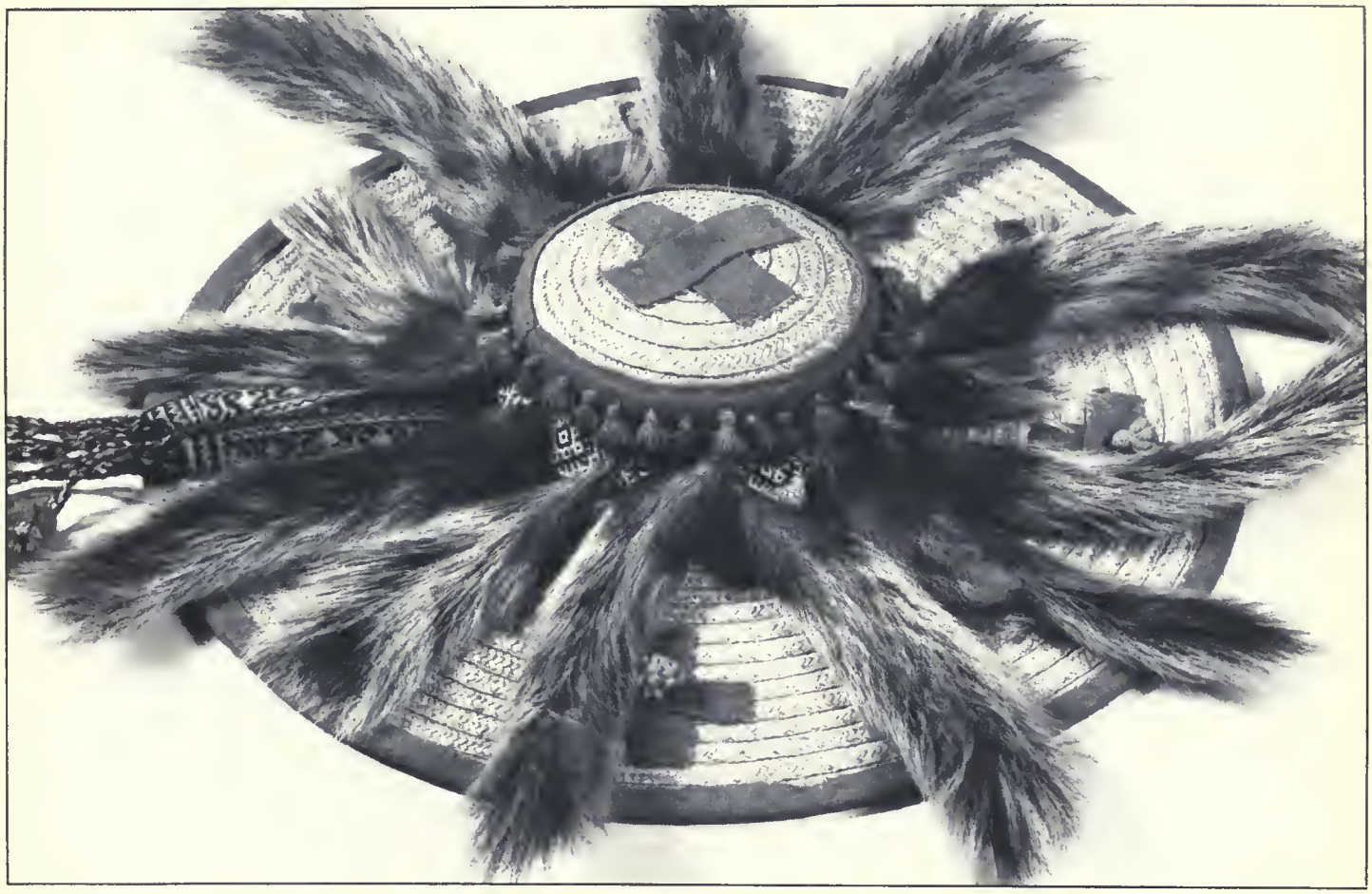
Because primates generally breed and mature slowly, large colonies would be needed to keep pace with yearly demands and to ensure genetic diversity and correct social unit size. The Southwest Foundation for Research and Education's (SFRE) baboon colony in San Antonio, TX, the world's largest, contains more than 1,100 baboons (*Papio cynocephalus*). SFRE also maintains small chimpanzee and squirrel monkey colonies. Although SFRE's colonies are non-commercial, the Charles River Breeding Laboratories' Florida Keys facility is. Charles River has established a colony of 2,500 rhesus macaques on an island previously uninhabited by primates. This year Charles River will sell its surplus of 560 primates to researchers for $500 to $1,000 each. Before India's rhesus ban, wild macaques could be purchased for less than $300. Continued primate behavior research may allow more colonies similar to SFRE's and Charles River's to be established.

In 1974 the National Institutes of Health established the Interagency Primate Steering Committee (IPSC). Composed of representatives from the National Science Foundation, the Department of Defense, the Department of Health, Education and Welfare, and the NIH, the committee's stated goal is " . . . to develop a unified approach to assure both short and long-term supplies of non-human primates for biomedical research activities." IPSC has developed a "National Primate Plan" which outlines future requirements for government agencies and proposes methods for obtaining primates. By coordinating use, it is hoped that sufficient experimental primate supplies can be maintained.

—John Hallagan, *Conservation News*.

| Species | Number Required 1977 | Availability |
|---|---|---|
| Rhesus macaque (*Macaca mulatta*) | 14,000 | Unavailable from the wild. Limited domestic production. |
| Long-tailed macaque (*Macaca fascicularis*) | 6,000 | Wild specimens commercially available. |
| Chimpanzee (*Pan troglodytes*) | 200 | Commercial trade only by special permit. Limited domestic production. |
| Baboons (*Papio spp.*) | 1,300 | Wild specimens commercially available. |
| African green monkey (*Cercopithecus aethiops*) | 2,100 | Wild specimens commercially available. |
| Squirrel monkey (*Saimiri sciureus*) | 4,500 | Wild specimens commercially available. |

# May and June at Field Museum



*Huichol shaman's hat, on view beginning May 5, with other examples of Huichol Indian art, in Hall 27. (Specimen on loan from the American Museum of Natural History.)*

*(May 15 through June 15)*

## New Exhibits

**"The Art of Being Huichol."** Opened May 5. A major traveling exhibition of more than 150 objects of Huichol Indian art. The exhibit was organized by the Fine Arts Museums of San Francisco and is sponsored by a grant from the National Endowment for the Arts and by the Museum Society of the Fine Arts Museums of San Francisco. The exhibit includes costumes, votive objects, weavings, embroidery, beadwork, and yarn "paintings." The "art of being Huichol" is the act of living a devout life, and spiritual themes dominate their art. The Huichol also value visionary experiences produced by the hallucinogenic peyote and these images are reflected in their dramatic yarn paintings. The Huichol live in an isolated area of Western Mexico, and they remain one of the few traditional Indian groups whose ancient beliefs and practices remain unchanged even today. Through September 3, Hall 27.

**"Lacquer Arts of Japan."** Opened May 9. More than 150 examples of finely crafted *inro,* (small sectional lacquer cases used to carry medicine); *netsuke,* (tiny carved pendants which hang from silk cords); and *ojime* beads, the status symbols of cultured merchants and a warrior aristocracy from 18th- and 19th-century Japan. Planned in conjunction with "Japan Today" festivities, some of these objects surpass the finest Renaissance goldwork in delicacy and perfection of design. The pieces displayed include items recently donated to the Museum by John Woodworth Leslie. Miniature landscapes, dreamlike still lifes, and mythic dragons are flawlessly carved into these lacquer ornaments, forming a microscopic universe out of gold dust and inlaid pearl. Examples of Chinese lacquer art will be exhibited for comparison. Hall 32. See story on page 12.

**"Treasures of Cyprus."** Opens June 14. An exhibit of jewelry and pottery that pre-dates Tutankhamun by 6,000 years. Bowls, jugs, vases, and religious idols made of stone, clay, and bronze reveal the Cypriot talent for using their natural resources to make important contributions to Western civilization. Situated at the crossroads of three continents—Europe, Asia, and Africa—Cyprus produced an art reflecting a remarkable assimilation of these foreign influences. Through September 16. Hall K.

*(Continued on back cover)*

# May and June at Field Museum

*(Continued from inside back cover)*

### Continuing Exhibits

**"A Stamp Sampler: Postage from Natural History."** A one-case exhibit that combines 63 natural history specimens with samples of philatelic or stamp art. Planned on a rotating basis to cover the four disciplines of natural history, the first phase is devoted to zoological specimens and their images on stamps. Exquisite seashells and butterflies are among the specimens mounted with a leaping jaguar and fox in the second floor lounge. "A Stamp Sampler" was conceived by Col. M. E. Rada, exhibit guest curator, and was designed by Peter Ho, a University of Illinois graduate student.

**"Feather Arts: Beauty, Wealth, and Spirit from Five Continents."** A breathtaking exhibit of 260 rare feather objects, assembled almost entirely from Field Museum's own collections. Headdresses adorned with iridescent beetles; hummingbird breasts glowing like gold on a shaman's headband; and an eerie hooded dance costume from the Cameroons, are just a few of the feather wonders on display in Hall 26. "Feather Art." is divided into five theme areas: the visitor can explore the amazing structure and function of the the feather, and learn how feathers are used to express man's ideas about beauty, wealth, and spirit. After its July 31 closing here, "Feather Arts" will travel to three other museums across the country.

### New Programs

Field Museum is honored to take part in **"Japan Today,"** an international festival celebrating the cultural, intellectual, and economic heritage of contemporary Japan. The Museum has opened an exquisite exhibit of Lacquer art from 18th- and 19th-century Japan; special weekend programs are also planned to coincide with this event:

"Nagashizuki—Japanese Hand Papermaking." Saturday, May 19, 1:30 p.m. To coincide with "Japan Today" cultural festivities, the Museum holds a multimedia lecture program on this ancient art form. With Timothy D. Barrett, craftsman and author. James Simpson Theatre. Admission: $3.50; Members, $2.00.

"Japan's Living Crafts." Sunday, May 20, at 11 a.m. and 2 p.m. A film introduction to the lacquerware, silk, pottery, paper art, ironwork, and enamelware designed by Japan's senior craftsmen. Running time: 22 minutes. A. Montgomery Ward Lecture Hall. Admission is free at the West door.

"The Path." The filming of an entire Japanese tea ceremony—an ancient tradition that has been described as a microcosm of Japanese culture. Sunday, May 27, 11 a.m. and 2 p.m. Running time: 34 minutes. For free admission to A. Montgomery Ward Lecture Hall, enter at the West door.

**"Great Scientists Speak Again."** Free weekend film programs honoring the world's foremost scientists. Dr. Richard M. Eakin, Professor Emeritus of Zoology, University of California at Berkeley, impersonates great men of science on film and makes a personal appearance as Charles Darwin for the final program. Humorous and dramatic, the films are also scientifically and historically accurate.

"Louis Pasteur": Friday and Saturday, May 18 and 19, at 2:30 p.m. Running time: 24 minutes. "Gregor Mendel": Friday and Saturday, May 25 and 26, at 2:30 p.m. Running time: 24 minutes. "Hans Spemann": Friday and Saturday, June 1 and 2 at 2:30 p.m. A. Montgomery Ward Lecture Hall. For free admission, enter at the West door.

"Charles Darwin." A live dramatic presentation with Professor Eakin impersonating the great naturalist: Saturday, June 9, at 2:30 p.m. James Simpson Theatre. Members, $2.00; nonmembers, $3.50.

**Summer Journey: "A to Z at Field Museum."** Self-guided tour leads families and children through a cross section of exhibits introducing them to the Museum's four main areas: anthropology, botany, geology, and zoology. Free *Journey* pamphlets available at the North Information Booth, and the South and West doors.

### Continuing Programs

**"Armchair Expeditions."** Geared for adult groups, these in-house "expeditions" include slide lectures and tours of selected exhibits. Dining arrangements available. Reservations are required. Call 922-0733 for more information.

**Spring Journey.** "The Meaning of Feathers." Through May 31. Self-guided tour leads families and children through exhibits to discover what birds and their feathers mean to various cultures. Free *Journey* pamphlets are available at the North Information Booth, and at the South and West doors.

**Friend or Foe? The Natural History Game.** Field Museum's popular "Anthropology Game" has been expanded to include botany, geology, and zoology. The object here is to determine which one of a pair of apparently similar specimens is harmful and which is not. See if you can distinguish a vampire bat, a headhunter's axe, a poisonous mineral, or a deadly mushroom from its benign look-alike. Ground floor, no closing date.

**On Your Own at Field Museum.** Self-guided tour booklets, adult- and family-oriented, are available for 25¢ each at the entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

**Volunteer Opportunities.** Limited opportunities are available in botany, geology, and zoology. Weekend volunteers with an interest in natural history are needed to develop and present weekend programs. For more information call 922-9410, X 360.

**May and June Hours.** The Museum is open daily from 9 a.m. to 6 p.m. except Fridays. On Fridays, the Museum is open from 9 a.m. to 9 p.m. throughout the year.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Closed Memorial Day, May 28. Obtain a pass at the reception desk, main floor.

June
1979

# FIELD MUSEUM OF NATURAL HISTORY BULLETIN

# Field Museum of Natural History Bulletin

June, 1979
Vol. 50, No. 6

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*President and Director:* E. Leland Webber

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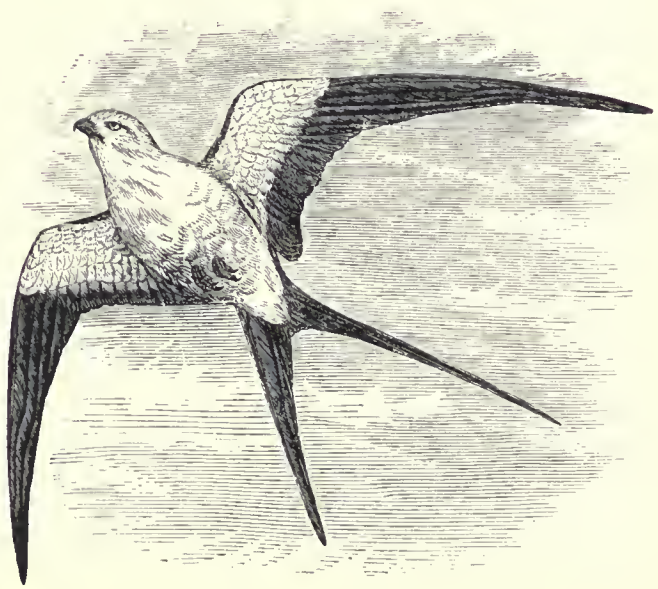
*Waterfall at Starved Rock State Park. Photo by John Kolar. Sign up now for June 16-17 tour of Starved Rock, Buffalo Rock, and Matthiessen state parks. See page 17 for details.*



# Field Museum Tours to Antarctica and China

**China, Nov. 5-25**

Peking's Forbidden City, the Summer Palace of the Dowager Empress, the bustling activity of Canton, the ancient pagodas of Kunming. These are just a sampling of the sights that lie in store for the 23 persons (Field Museum members and their families) who visit China on Field Museum's exclusive tour this November .

In addition to fourteen days in China, three days and two nights will be spent in London. The tour escort will be Mrs. Katharine Lee, a Field Museum volunteer in the Department of Anthropology who is fluent in five Chinese dialects. Additional guides in China will be provided by the China International Travel Service. The tour cost—$4,400 (which includes a $500 donation to Field Museum)—is based upon double occupancy and includes round trip air fare from Chicago to China. Advance deposit required: $500.00 per person.

For full itinerary, additional details, and registration information on all tours, please write or call Michael J. Flynn, Field Museum Tours, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.

**Antarctica, Jan. 6-30, 1980**

Until recently, only explorers were able to view antarctica's wondrous beauty. There is no destination more remote, more unspoiled by the encroachments of civilization. Our itinerary includes the Falkland Islands, a visit to the Patagonian coast, the South Georgia Islands, the South Orkney Islands, and of course, antarctica. Dr. Edward Olsen, curator of mineralogy, will be tour lecturer.

The cruise vessel will be the 3,200-ton tourist ship *M.S. World Discoverer*, registered in Hong Kong, which will take us from Punta Arenas, Argentina, onwards. Built in 1974, the one-class vessel has all outside cabins with private lavatories and showers. The ship's staff includes a fully qualified physician. The tour leaves Chicago Jan. 6, 1980 and returns Jan. 30. Prices per person: C deck twin: $3,230; C deck single: $4,870; B deck twin: $3,570; B deck single: $5,390; A deck, twin: $3,930. Air fare, in addition, is $1,225 (round trip between Chicago and Punta Arenas, Argentina). Included in the tour price is a tax-deductible donation of $500.00 to Field Museum. Deposit required at time of registration: $1,000.00 per person.

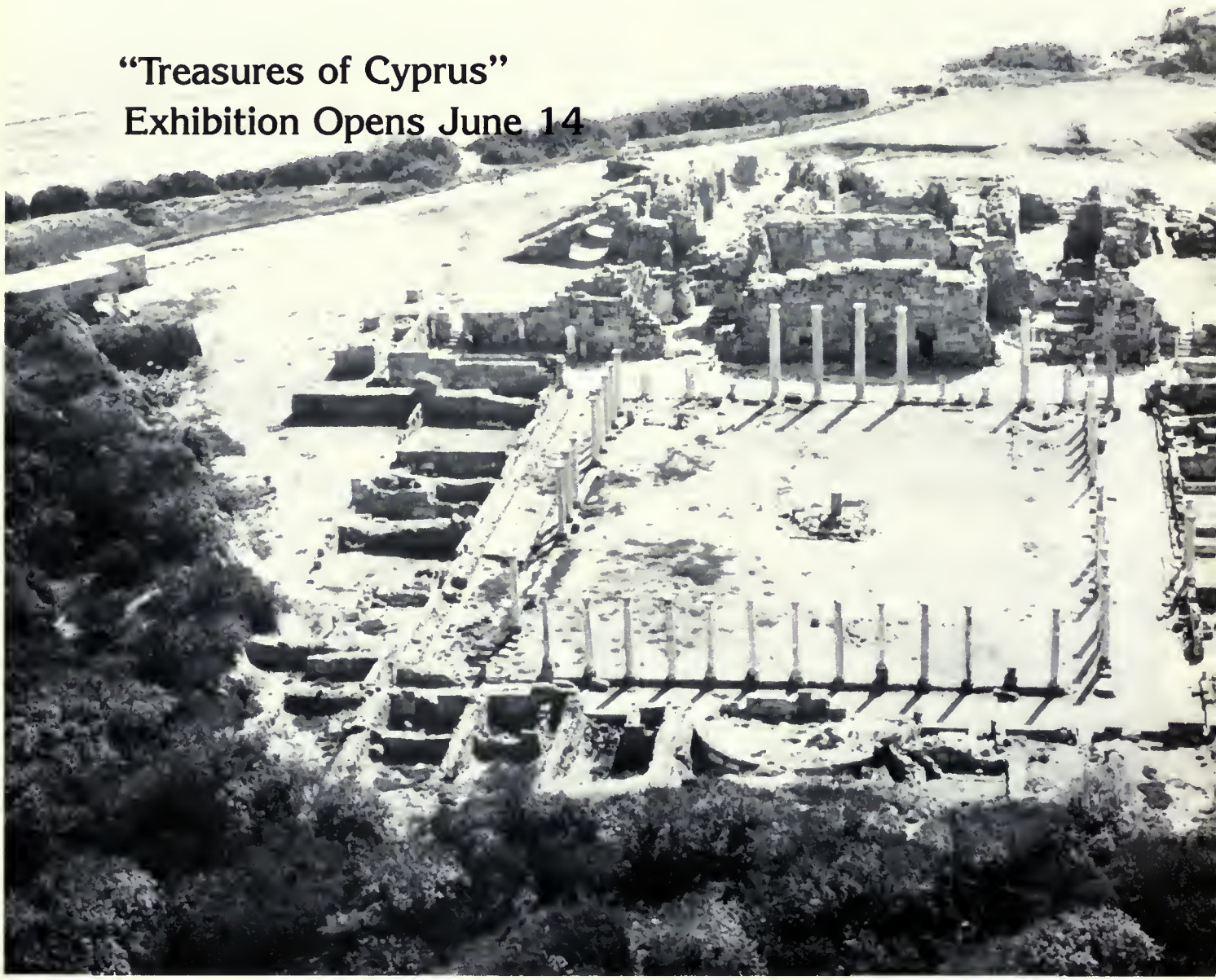
*Deception Island, antarctica*

# *Who Were the Lusignans?*

## A Medieval Approach to Cypriot Archaeology

*BY* DONALD WHITCOMB

### "Treasures of Cyprus" Exhibition Opens June 14



*Ruins of Salamis*

PHOTOS COURTESY THE SMITHSONIAN INSTITUTION TRAVELING EXHIBITION SERVICE

THOSE WHO ARE FAMILIAR WITH the history of the Crusades may know of the principalities and feudal kingdoms which were established on the Levantine (eastern Mediterranean) coast and lasted for hundreds of years; they may also have some understanding of the tremendous exchange of ideas concerning government, society, culture, and the arts that prevailed between these Europeans and their oriental neighbors.

An aspect of this history which is perhaps less widely known but which was one of the immediate results of the Crusades was the establishment of a Crusader kingdom on the island of Cyprus. This Lusignan kingdom (named for its ruling family, the Lusignans, who came from western France) lasted for almost three centuries (1192-1489) after the fall of the Levantine kingdoms.

Probably even enthusiasts of this segment of Cypriot history have not considered that the

*Donald Whitcomb is Field Museum's newly appointed assistant curator of Middle Eastern archaeology and ethnology.*

Lusignan period is but a late chapter in the long story of European and oriental interchange on this island. Much of the information we now have about this interchange has been revealed to us through archaeological research, and the archaeology of medieval Cyprus can be seen as a beginning point in the unravelling of the history of civilization on this island and throughout the Mediterranean.

On June 14 the exhibition "Treasures of Cyprus" will open at Field Museum. This collection of some 150 artifacts, representing the art and archaeology of Cyprus, was organized by the government of Cyprus to honor the American Bicentennial and loaned to the United States. The exhibition is being circulated by the Smithsonian Institution Traveling Exhibition Service. In viewing this exhibition, we are reminded of the pivotal importance of this small island (about twice the size of New York's Long Island) in the historical changes and political vicissitudes from the earliest phases of western civilization. Patterns of present day international relationships often have startlingly similar antecedents in earlier historical periods.

The archaeological collections in the "Treasures of Cyprus" exhibition include a number of very beautiful glazed vessels dating from the medieval period. Many of the finest were found in graves of the Lusignans, this practice of depositing valuables with the dead harkening back to some of the earliest archaeological periods. One of the richest Lusignan graveyards was at Episkopi near Limassol, on the southern coast, where Richard the Lion-Hearted first landed in 1191. The medieval Cypriot view of this English king differed greatly from the one we usually hear; one contemporary commentator on the effects on Cyprus of the Third Crusade stated

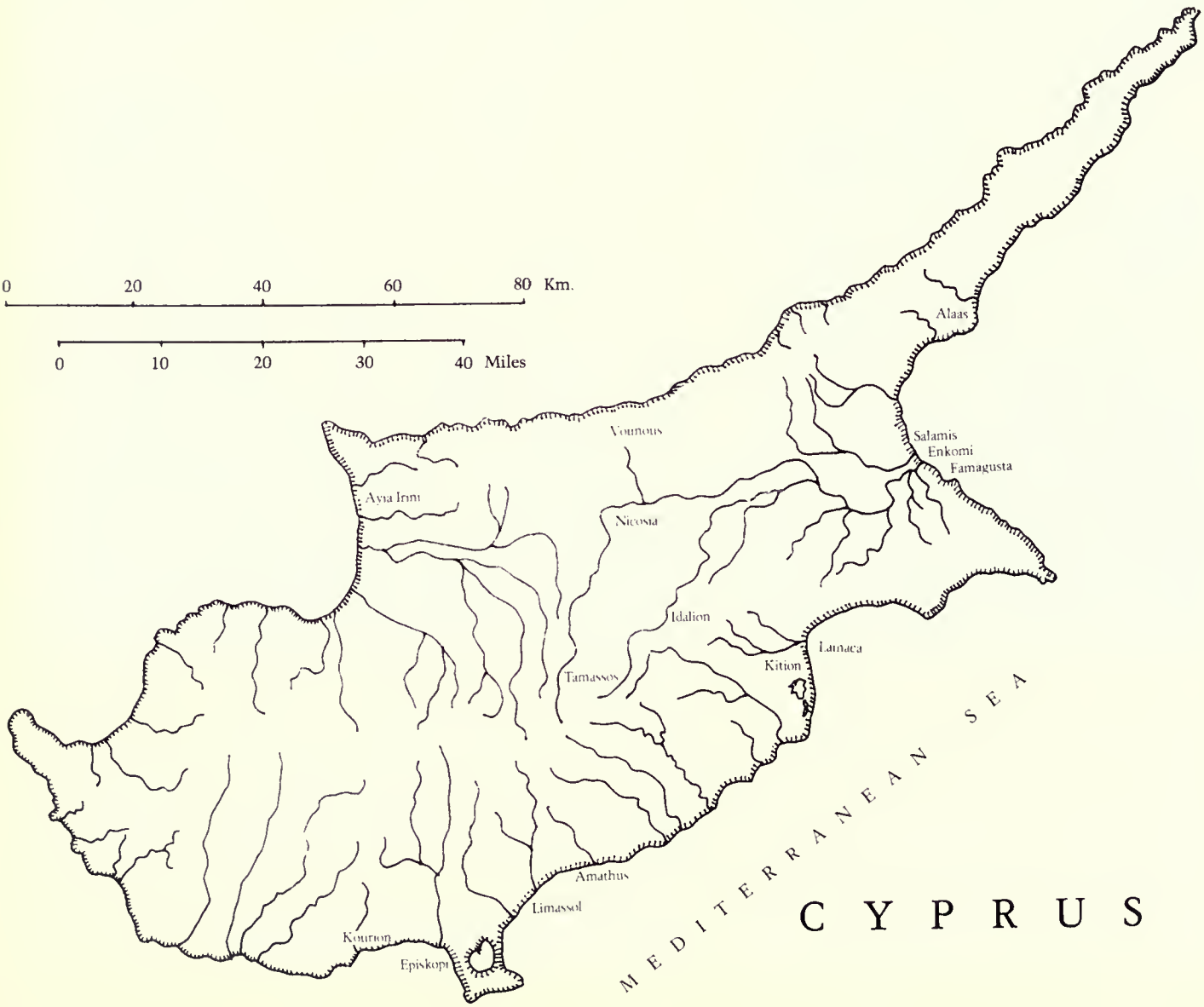
> England is a country beyond Rumania in the north, out of which [came] a cloud of English with their sovereign, embarking on large vessels called smacks, and sailed towards Jerusalem. . . . The wicked wretch achieved naught against his fellow wretch Saladin, but achieved only that he sold our country to the Latins. . . .

It was as a result of the failure of the Third Crusade that this orthodox Christian part of the Byzantine empire was taken over by the Lusignan dynasty founders. When an Arab sultan finally reclaimed all of the Levant for Islam with the fall of Acre in 1291, many more European knights settled in the feudal principality of Cyprus. The Lusignans, who continued to be crowned as both King of Cyprus and King of Jerusalem for almost 300 years, turned the island into an almost perfect model of chivalry and a sort of Camelot — if one neglects the interests and aspirations of the "humble folk."

The growth and prosperity of the island kingdom during the thirteenth and fourteenth centuries was due mainly to the vigorous trade between Europe and the Moslem East. This was conducted via Cyprus by Genoese and Venetian merchants. The latter, who were particularly important, ruled the island in the late fifteenth and in the sixteenth centuries. (The real-life model of Shakespeare's Othello is generally believed to have been, not a black Moor, but an Italian merchant named Moro who lived in the great port of Famagusta.) A fourteenth-century traveller described Cyprus:

> Moreover there are very rich merchants, a thing not to be wondered at, for Cyprus is the furthest of Christian lands, so that all ships and all wares, be they what they may, and come they from what part

BLACK SEA
Corsica
ITALY
Sardinia
GREECE
TURKEY
Sicily
Rhodes
Cyprus
Crete
MEDITERRANEAN SEA
AFRICA


0 20 40 60 80 Km.
0 10 20 30 40 Miles
Alaas
Vounous
Salamis
Enkomi
Famagusta
Ayia Irini
Nicosia
Idalion
Larnaca
Kition
Tamassos
MEDITERRANEAN SEA
Amathus
Limassol
Kourion
Episkopi
CYPRUS

> of the sea they will, must needs come first to Cyprus, and in no wise can they pass it by, and pilgrims from every country journeying to the lands over sea must touch at Cyprus.

The growth of these merchants is reminiscent of earlier success of the Phoenicians (first half of the first millenium B.C.), specialists in commerce who were drawn to Cyprus for its great copper resources. (The word "copper," or its root, *cuprum* or *cyprium*, may be from the name of the island, or vice versa.) The Phoenicians settled in strategic coastal sites such as Kition (Citium, or Biblical Chittim), on the eastern coast and established relationships with towns like Tamassos and Idalion in the copper-bearing mountains of the interior.

Commerce in copper also occupied the Mycenaeans in the middle of the second millennium B.C., a search echoed in Homer's *Odyssey*:

> So now, going down to my ship and sailing with my companions across the wine-dark sea, towards men speaking strange tongues, I carry shining iron to Temese (Tamassos) in quest of copper.

Cyprus in this period (the Late Bronze Age, called in Cyprus the Late Cypriot period) was known to its trading partners as the country of Alashiya. These trading partners included not only Mycenaean Greece but the kingdoms of the Levant and Egypt, where Cypriot ceramics today bear mute witness to commerce that occurred during the eighteenth dynasty (1570-1293, the dynasty of Tutankhamun). The influence of neighboring regions upon Cypriot history becomes clearer during the first millennium B.C. (the Iron Age), for which patterns of political domination are better documented. The island was divided into separate city-states, each with its king; most of these were part of the Mycenaean legacy. By 708 B.C., these kings had submitted to the Assyrian Sargon II; subsequently the political domination shifted briefly to the Egyptians and then to the Persian empire. Alexander the Great (356-323 B.C.) reintroduced a Greek element, but his successors, the Ptolemies, ruled Cyprus from Egypt into the first century B.C.

The Romans introduced what might be considered a first Italian influence upon the island, an interest which was two-fold. On the one hand, the commercial role of Cyprus in the empire fostered the development of copper mining on an enormous industrial scale, while cities such as Salamis became cosmopolitan centers of wealth and beauty. The Romans also seem to have responded to the natural beauty of the island and to its reputation as the birthplace of Aphrodite, goddess of love. The very ancient cult center at Paphos was adorned with a popular and famous temple and it is probably no accident that Mark Antony gave the island as a love-gift to Cleopatra in 36 B.C. (The lingering power of Aphrodite may perhaps be seen in the twelfth century, when Richard the Lion-Hearted landed on Cyprus with his betrothed, the beautiful Berengaria, and married her.)

Aphrodite and the pagan rites on her island soon gave way to stronger, more spiritual influences. In 45 A.D. the Apostle Paul and Barnabas, the early Christian missionary, landed on the island and managed to convert Sergius Paulus, the Roman consul. Cyprus remained Christian, eventually becoming part of the eastern Byzantine empire, although the newer eastern power based on Islam made occasional attempts to bring Cyprus under its control. It was the Arab geographer Shams-eddin Muqaddasi who neatly summarized the political patterns of the island: "The island is in the power of whichever nation is overlord in these seas."

## CHRONOLOGY

| Period | Estimated Date |
|---|---|
| Neolithic | IA: 5800-5250 B.C.<br>IB: 5250-4950 B.C.<br>II: 3500-3000 B.C. |
| Chalcolithic | I: 3000-2500 B.C.<br>II: 2500-2300 B.C. |
| Early Bronze Age or Early Cypriot | I: 2300-2100 B.C.<br>II: 2100-2000 B.C.<br>III: 2000-1850 B.C. |
| Middle Bronze Age or Middle Cypriot | I: 1850-1800 B.C.<br>II: 1800-1700 B.C.<br>III: 1700-*ca.* 1550 B.C. |
| Late Bronze Age or Late Cypriot | IA: *ca.* 1550-1450 B.C.<br>IB: 1450-1400 B.C.<br>IIA: 1400-1300 B.C.<br>IIB: 1300-1230 B.C.<br>IIIA: 1230-1190 B.C.<br>IIIB: 1190-1150 B.C.<br>IIIC: 1150-1050 B.C. |
| Iron Age | Begins *circa* 1050 B.C. |
| Cypro-Geometric | I: 1050-950 B.C.<br>II: 950-850 B.C.<br>III: 850-725 B.C. |
| Cypro-Archaic | I: 725-600 B.C.<br>II: 600-475 B.C. |
| Cypro-Classical | I: 475-400 B.C.<br>II: 400-325 B.C. |
| Hellenistic | I: 325-150 B.C.<br>II: 150-50 B.C. |
| Roman | I: 50 B.C.-150 A.D.<br>II: 150-250 A.D.<br>III: 250-330 A.D. |
| Byzantine<br>Lusignan Medieval | 330-1191 A.D.<br>1192-1489 A.D. |
| Venetian | 1489-1571 A.D. |
| Turkish Occupation | 1571-1878 A.D. |
| British Occupation | 1878-1960 A.D. |
| Declaration of Independence of the Republic of Cyprus | August 16, 1960 |

The tides of political change may be seen most vividly in the archeology of Cyprus's major ports. During the Lusignan and Venetian periods, the very prosperous trade with the Saracen countries of the Levant and Egypt was centered on Famagusta, located on the island's eastern coast. Not far from Famagusta are the remains of Constantia, the Byzantine manifestation of the classical emporium of Salamis. Salamis was preceded by Enkomi, a Late Bronze Age port already thriving in the second millennium B.C. A similar succession of port-sites may be seen in the south with the early Kourion followed by Curium, then Amanthus, and finally by Limassol. A second geographical constant is the succession of towns on the central plain of the interior where early city-states such as Tamassos, Idalion, and Ledra found a final manifestation in the country's present capital, Nicosia.

The recurring importance of a given area of the island can even be seen in the final fall of the Lusignans when, abandoned by their Venetian and Genoese allies, they were defeated by an Egyptian Mamluk army at the Battle of Khirokitia, the site of the oldest and most important Neolithic settlement in Cyprus. This Mamluk control of Cyprus is especially interesting to me, even though it was short-lived, because my wife, Janet Johnson, and I are currently excavating Mamluk remains in Egypt. In fact, our site, Quseir al-Qadim, a small port on the Red Sea, has glazed ceramics somewhat similar to those used by the Lusignans. We also found one Crusader coin in the excavations — perhaps a piece of change from the sale of some spices from the East. I have, therefore, special interest in the archaeology of medieval Cyprus as a parallel to the "Islamic archaeology" of its neighboring countries.

Both medieval Cypriot and Islamic archaeology fall into the range which many ar-

*Theater at Kourion (Curium).*

*Khirokitia, the oldest and most important Neolithic settlement in Cyprus*

*Bull-shaped vessel. Early Cypriot period. Height: 12.5 cm.*

*Enkomi (Alasia), on northeast coast.*

chaeologists rather disdainfully call the "late" periods; some of the materials which I study are hardly archaeological at all. But these sherds and pots, even if only a few hundred years old, have a story to tell — they are evidence, albeit fragmentary — of how people lived. Some aspects reflected in the pottery record were never written down; other information may be checked against documentary sources. Because modern archaeology is asking increasingly difficult questions about cultural processes and interactions, it is useful to have such a field of archaeology — where inferences and interpretations may be checked occasionally — to ensure we do not explain too many things as "religious ritual" or as flying saucers.

Thus, from looking at the archaeological remains of the Lusignans, we may be able to answer many questions about how the Crusaders lived and how their feudal society worked. But perhaps more important, as I have tried to suggest here and as suggested in the arrangement of the "Treasures of Cyprus" exhibition, the glazed ceramics of the Lusignans can show us something about the interpretation and appreciation of artifacts from earlier archaeological periods. The Lusignan pieces in the exhibition are not displayed all together, within the series of chronological cases; rather, each individual piece is grouped with earlier pieces which it illuminates in one fashion or another. (Thanks to John Carswell, curator of the Oriental Institute Museum, at the University of

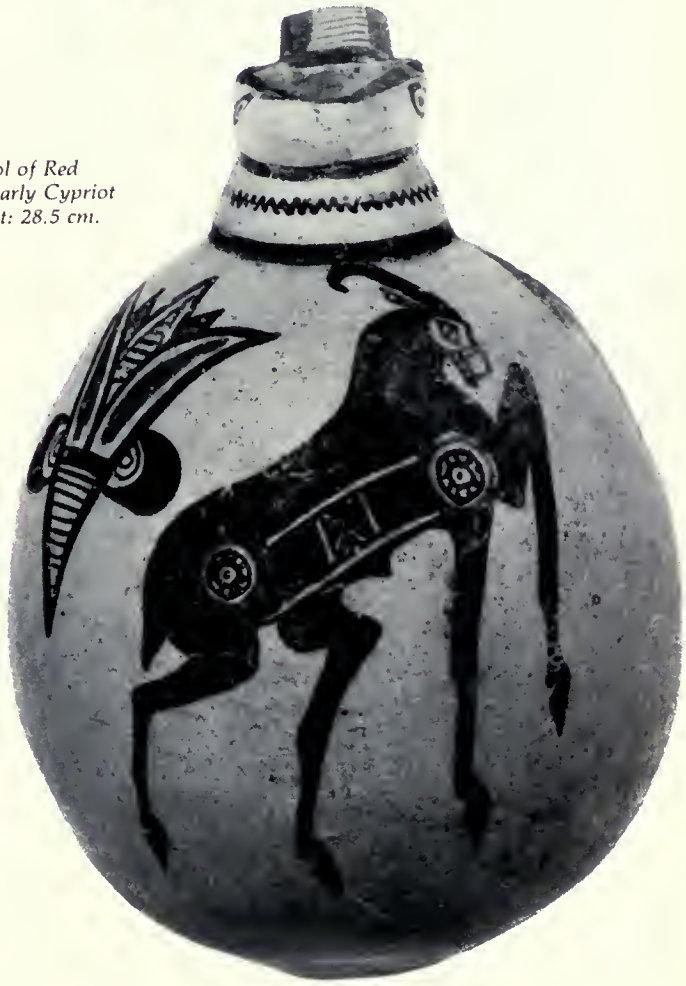
Chicago, a few medieval sherds from that museum's collections have been included in the exhibition for purposes of comparison.) For instance, on the bottom of a medieval goblet a *sgraffito*, or "scratched" design, depicts a wedding scene in which the design of the clothes of an embracing couple intermingles; the artistic conceptualization is rather similar to a so-called plank-shaped idol from the Early Cypriot period (*ca.* 2000 B.C.). The gestures of a dancer shown on another medieval goblet seem to reflect the postures of little figurines made over 2,000 years earlier, and designs on a medieval wine jar seem to imitate designs of earlier periods. What we might have here is conscious reproduction of earlier artistic shapes or motifs and, on the other hand, a graphic illustration of more basic, shared human characteristics.

On a more abstract scale, the patterns of settlement and commerce suggested above might also be seen as conforming to atemporal patterns of human interaction stretching across different and unconnected time periods. This is not to suggest so much a cyclicality of history as an isolation of certain constraints which may produce superficial, or even deeper, nearly identical responses. When the Mycenaeans or Ptolemies are described as a "warrior aristocracy," just how different might their society have been from that of Lusignan crusaders? It is through juxtapositions such as are possible within this exhibition of Cypriot antiquities that questions like these might be raised and ideas suggested.

*Plank-shaped idol of Red Polished ware. Early Cypriot III period. Height: 28.5 cm.*

*Terracotta figurine. Cypro-Archaic II period, from Kouklia. Height: 14.5 cm.*

*Lusignan glazed bowl; 14th cent. A.D. Height: 9 cm.*



*Jug decorated in "free-field" style. Cypro-Archaic period. Height: 22.5 cm.*

*Bronze ring from top of tripod stand. Inscription is in Cypro-Minoan script. Late Cypriot III period. From Myrtou-Pigadhes. Diam.: 11.9 cm.*

*Marble head of satyr. Roman (Julio-Claudian period). From Kourion. Height: 19 cm.*

*Lusignan glazed vase; brown and green sgraffito; 14th cent. From Nicosia. Height: 30.5 cm.*

## "Treasures of Cyprus"

These and other art objects from nearly 8,000 years of Cypriot history will be on view in Hall K beginning June 14.

# The Tsavo Man-Eaters

BY LAWRENCE S. KOLCZAK

UNLIKE THE OTHER SPECIMENS in Hall 22 at Field Museum, these two male lions are not attractive representatives of their species. Their skins are covered with scars, and they lack even the hint of a majestic mane. Their contribution to the African exhibit lies not in their physical appearance, but in their bizarre and macabre story. They are the documented killers of twenty-eight human beings. Their insatiable appetite for human flesh disrupted construction of the Uganda Railroad for nine months.

In March, 1898, Col. J. H. Patterson, a British engineer, arrived in what is now Kenya. Only 130 miles of track had been completed on the railroad which would connect the coastal city of Mombasa with the shores of Lake Victoria, about 750 miles inland. Thousands of laborers had been brought over from India to work on this project, and most of them were camped at the railhead, an outpost called Tsavo. Patterson was assigned to direct construction of a railroad bridge across the Tsavo River at this location. It is from the published account of his ordeal with the man-eaters that the quoted excerpts here are taken.

A few days after Patterson's arrival at Tsavo, a lion entered one of the camps and dragged a sleeping workman from his tent. Patterson followed the trail.

> On reaching the spot where the body had been devoured, a dreadful spectacle presented itself. The ground all round us was covered with blood and morsels of flesh and bones, but the . . . head had been left intact, . . . the eyes staring wide open with a startled, horrified look in them. . . . we found that two lions had been there and had probably struggled for possession of the body.

Thinking the lions might return to the same camp that night, Patterson lay in wait. But the lions attacked another camp, a half-mile away. The camps were scattered along eight miles of track, and there were several thousand workmen to prey upon.

Despite the heat, tent doors were no longer left open at night. The workmen constructed *bomas* (barriers made from thorn bushes) around their camps. Still, every few nights, a man was carried off and devoured. Time after time, the lions eluded Patterson's ambush attempts.

Occasionally, the man-eaters made a mistake. One of them tore into a tent occupied by fourteen men, and made off with a sack of rice. In another incident, a man was rudely awakened as a lion stole his mattress out from under him.

As the railhead moved further inland, most of the laborers went with it. The few hundred workers remaining behind to complete the bridge became more conscious of the lions' activities. They strengthened the thorn *bomas* encircling their camps, and kept fires burning all night. Watchmen rattled empty oil cans to frighten off marauders. Animal carcasses, laced with poison, were left outside the camps.

Despite these precautions, on April 22, a lion penetrated the boma of the hospital camp, mauled two men, killed a third and dragged the victim out through the thorns. Immediately, the hospital was moved closer to the other camps. That night while Patterson stood watch at the abandoned hospital, a lion attacked the new hospital camp. It jumped over the *boma*, poked its head under the side of a tent, and seized a man by the foot. It pulled the struggling man from the tent, took him by the neck and killed him with a few vicious shakes.

> The brute then seized him . . . like a huge cat with a mouse, and ran up and down the *boma* looking for a weak spot to break through. This he presently found and plunged into, dragging his victim with him and leaving shreds of torn cloth and flesh as ghastly evidences of his passage through the thorns.

Patterson found the man's remains the next morning. "Very little was left . . . only the skull, the jaws, a few of the larger bones and a portion of the palm with one or two fingers attached."

The hospital camp was again moved to a

more secure location and encircled by a thicker, higher *boma*. At the abandoned camp, some tents were left standing and a few cattle were tied as bait. Patterson and the medical officer concealed themselves in a nearby boxcar.

The men heard the growls of a lion approaching the camp. Then there was silence, and they knew the lion was stalking its prey. They moved into the open doorway, expecting at any minute to see the lion enter the *boma*. After a few more minutes of silence, the lion suddenly lunged at the boxcar's open door. The startled men fired simultaneously, but missed the lion. The noise of the shots echoing in the empty car were enough to frighten him off.

The boxcar experience apparently discouraged the lions from frequenting Tsavo. For more than six months, they restricted their activities to a district ten miles away. But in November, they returned and made a particularly bold attack on one of the camps.

> . . . in the middle of the night one of the brutes was discovered forcing its way through the *boma*. The alarm was at once given, and sticks, stones and firebrands were hurled in the direction of the intruder. All was of no avail, however, for the lion burst into the midst of the terrified group, seized an unfortunate wretch amid the cries and shrieks of his companions, and dragged him off through the thick thorn fence. He was joined outside by the second lion . . . they did not trouble to carry their victim any further away, but devoured him within thirty yards of the tent where he had been seized.

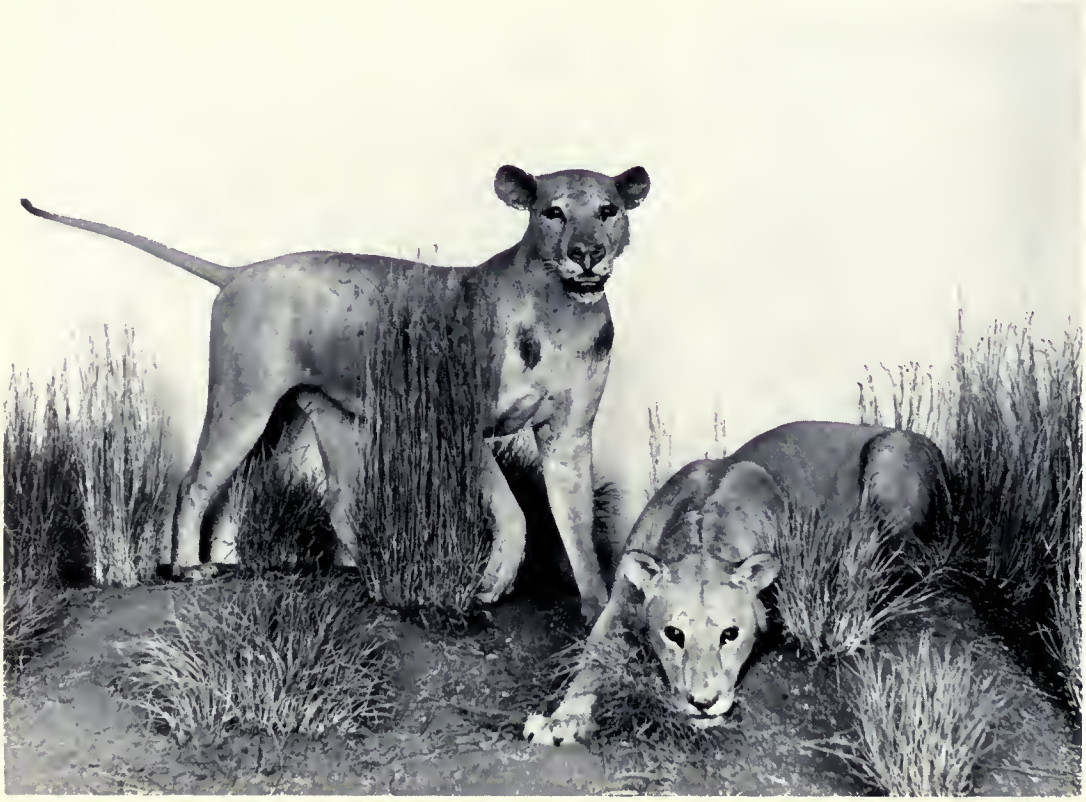
Up until this time, only one of the lions entered the camps and made the kill. The other joined him outside to share the meal. Now, they entered the camps together, and each of them seized a victim. They feasted within hearing distance of the camps, and, in one instance, ignored more than fifty shots fired into the darkness in their direction.

> I have a very vivid recollection of one particular night when the brutes seized a man from the railway station and brought him close to my camp to devour. I could plainly hear them crunching the bones, and the sound of their dreadful purring filled the air and rang in my ears for days afterwards. The terrible thing was to feel so helpless; it was useless to attempt to go out, as of course the poor fellow was dead, and in addition it was so pitch dark as to make it impossible to see anything.

This new reign of terror caused the workmen to strike. By the hundreds, they piled aboard the first passing train. The few who remained did little construction work. They spent their time fortifying their sleeping places. Beds were perched in trees, and atop water towers. Some men slept in pits which they covered with railroad ties.

Patterson's request for assistance was finally answered, and on the evening of December 3, district officer Whitehead and a native soldier arrived at Tsavo. But before they had walked the half-mile from the station to Patterson's camp, they were attacked by one of the lions. Whitehead

*The notorious Tsavo man-eaters, on view in Hall 22.*



was mauled, and the soldier was carried off and devoured.

The next day, several more officials arrived, along with a detachment of twenty *sepoys*, or native police. Patterson deployed his reinforcements, posting armed men in trees near every camp. He also had a trap constructed of railroad ties and concealed it within a tent. As bait, two armed *sepoys* slept in a protected compartment at the rear of the trap.

That night, Patterson heard the clatter of the trap door.

> The bait-sepoys . . . were each armed with a Martini rifle, with plenty of ammunition. . . . they were so terrified when he came in and began to lash himself madly against the bars, that they . . . were too unnerved to fire. . . . then when at last they did begin . . . , they fired with a vengeance — anywhere, anyhow. Whitehead and I were at right angles to the direction in which they should have shot, and yet their bullets came whizzing all round us. Altogether they fired over a score of shots, and in the end succeeded only in blowing away one of the bars of the door, thus allowing our prize to make good his escape.

After a week of unproductive nightly vigils and daylight forays into the wilderness, the reinforcements returned to the coast.

Within days of their departure, the lions entered a camp and, failing to find a human victim, killed a donkey. Patterson found the half-eaten carcass and had a makeshift scaffold erected nearby. That night, from this unsteady perch, he heard one of the lions approach.

> . . . an angry growl . . . told me that my presence had been noticed. . . . matters quickly took an unexpected turn. . . . instead of either making off or coming for the bait . . . , the lion began stealthily to stalk *me!* For about two hours he horrified me by slowly creeping round my crazy structure, gradually edging his way nearer and nearer.
>
> . . . I could barely make out his form . . . I took careful aim and pulled the trigger. . . . I kept blazing away in the direction in which I heard him plunging about. At length came a series of mighty groans, gradually subsiding into deep sighs, and finally ceasing altogether; . . . one of the "devils" who had so long harried us would trouble us no more.
>
> . . . I examined the body and found that two bullets had taken effect. . . . The prize was indeed one to be proud of . . . . The only blemish was that the skin was much scored by the *boma* thorns through which he had so often forced his way in carrying off his victims.

In a similar ambush, the second man-eater was hit twice by shotgun slugs, but managed to escape into the darkness. Ten days passed with no sign of the lion, and Patterson hoped it had died of its wounds. But on December 27, it entered a camp and menacingly circled a tree in which several workers had taken refuge.

Patterson stationed himself in that tree the following eveing, and succeeded in putting two more bullets into the lion.

> We awaited daylight with impatience, and at the first glimmer of dawn we set out to hunt him down. I took a native tracker with me, so that I was free to keep a look-out, while Mahina followed immediately behind with a Martini carbine. . . . suddenly a fierce warning growl was heard right in front of us. Looking cautiously through the bushes, I could see the man-eater . . . . I at once took careful aim and fired. Instantly he sprang out and made a most determined charge . . . . I fired again and knocked him over; but in a second he was up once more and coming for me as fast as he could . . . . The terror of the sudden charge had proved too much for Mahina, and both he and the carbine were by this time well on their way up a tree. In the circumstances there was nothing to do but follow suit, . . . I had barely time to swing myself up out of his reach . . . .
>
> . . . [I] seized the carbine . . . and the first shot I fired from it seemed to give him his quietus, for he fell over and lay motionless. Rather foolishly, I at once scrambled down from the tree and walked up towards him. To my surprise . . . he jumped up and attempted another charge. This time, however, a Martini bullet in the chest and another in the head finished him for good . . . .

With considerable difficulty, Patterson prevented the workmen from tearing the carcass to pieces. Upon examination, he found that the shotgun slugs had barely penetrated the lion's back, and that there were six bullet holes in the body. As with his companion, the second man-eater's skin had been disfigured by its numerous passages through the thorns.

As the news of Patterson's success spread, the strikers returned and work on the railroad resumed. The workmen presented him with an inscribed silver bowl. Patterson's ordeal was even mentioned by the British prime minister, before the House of Lords. And when President Theodore Roosevelt read the story, he wrote to a friend: "I think that the incident of the Uganda man-eating lions, described in those two articles you sent me, is the most remarkable account of which we have any record. . . ."

Patterson's final words on the subject:

> Well had the man-eaters earned all this fame; they had devoured between them no less than twenty-eight Indian coolies, in addition to scores of unfortunate African natives of whom no official record was kept.

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*The Tsavo man-eaters are not Field Museum's only connection with Col. J. H. Patterson. His son, Bryan Patterson, a distinguished paleontologist, served on the Field Museum staff from 1926 to 1955. During the summer of 1979, Bryan Patterson returns to Field Museum as visiting curator.*

# Field Museum Tours to Peru and the Cook Islands

**Peru, Oct. 27-Nov. 15**

A 20-day tour will visit the ruins of Machu Picchu, Chan Chan, Pachacamac, Purgatario, and others. The Plains of Nazca (viewed from low-flying aircraft), the Guano Islands, and the Pisac Indian Fair will also be visited. The group, limited to 20, will be led by Dr. Michael Moseley, associate curator of middle and South American archaeology and ethnology, and by Robert Feldman, assistant in archaeology. A tour escort will also accompany the group.

The tour cost—$2,998 (which includes a $500 donation to Field Museum)—is based upon double occupancy and includes round trip air fare between Chicago and Peru and local flights in Peru. Delta Airlines will be used between Miami and Chicago, connecting with Aeroperu. Deluxe accommodations will be used throughout. The package includes all meals, including inflight meals; all sightseeing; all admissions to events and sites; all baggage handling; all necessary transfers; all applicable taxes and tips; all applicable visa fees. Advance deposit: $250.00 per person.

**Cook Islands, July 14-31**

Between Tahiti and Fiji, the Cook Islands offer one of the last relatively unspoiled island areas. Rarotanga, with towering peaks, is surrounded by coral islets. A new 150-room hotel provides a base with modern comforts. Aitutaki, an hour away by small plane, is a classic atoll lagoon, superb for snorkeling or SCUBA diving. There, a country-style hotel will provide two nights' accommodation. Mangala, also a short flight away, will be visited, with a journey to its lagoon areas. The last three days will be spent in Hawaii.

The tour's scientific lecturer/escorts will be Dr. Alan Solem, curator of invertebrates, Dr. Robert K. Johnson, associate curator of fishes, and Dr. Elizabeth L. Girardi, research associate in invertebrates. The tour, limited to 25 persons, will travel via Air New Zealand. The tour cost — $2,650 (includes a $400 donation to Field Museum) — is based upon double occupancy and includes round trip air fare to and from Chicago. Also included is all inter-island transportation, all meals (except lunches in Hawaii) and all inflight meals, all admissions to special events; all baggage handling, plus all transfers; all applicable taxes and tips. Advance deposit: $400 per person.

For additional information and reservations for all tours, call or write Michael J. Flynn, Field Museum Tours, Roosevelt Rd. at Lake Shore Dr., Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.

# Weekend Tours to Galena, Baraboo, and Starved Rock

**Baraboo, Starved Rock, Galena**

**Starved Rock.** June 16-17. $82.00. Group leader: Dr. Gordon Baird, assistant curator of fossil invertebrates. Buffalo Rock State Park and Matthiessen State Park will also be visited. Overnight accommodations will be at Starved Rock Lodge.

**Baraboo.** June 9-10. $70.00. Group leader: Dr. Edward Olsen, curator of mineralogy. Hiking clothes are strongly recommended for the scheduled hikes. The trip is not suitable for children, but younger people interested in natural history are welcome.

**Galena.** Oct. 12, 13, 14. $150.00. Group leader: Dr. Bertram G. Woodland, curator of petrology. In addition to viewing geological features, tour members will have the opportunity to explore historic Galena's charming downtown area, with its variety of pre-Civil War architecture. Accommodations for two nights will be provided at Chestnut Mountain Lodge.

Rates quoted above are per person, double occupancy (singles on request). Included are all expenses of transportation on charter buses to and from Chicago, and accommodations in first class resort hotels; all meals and gratuities, except personal extras such as special food service. Advance deposit: $15.00 per person.

*Baraboo tour visits beautiful Devil's Lake, Wisconsin, June 9-10.*

# Taylor Camp, Hawaii

## *The Life and Death Of a Hippie Community*

*BY* THOMAS J. RILEY *AND* KARMA IBSEN-RILEY

*Photos courtesy of the authors*

MOST ARCHAEOLOGICAL RESEARCH focuses on the remains of man's remote past. From ancient Egypt to the Mayan rainforest and even to southern Illinois the archaeologist's trowel peels away at the hidden corners of mankind's history to reveal the mosaic of the human condition over time. This involvement with the distant past gives the impression that the archaeologist's domain is purely ancient history, the story of human evolution and cultural development until the time of the invention of writing.

Nothing could be further from the truth. Archaeologists are interested in the material aspects of human cultures right down to the present day. Most of us rarely get the chance to study recently abandoned archaeological sites, but there is a continuing growing interest in what the remains of our own society can tell us about human behavior in other societies as well as in our own.

Archaeologist Mark Leone has recently studied Mormon communities in Arizona and elsewhere, systematically demonstrating the relationships between Mormon social organization, ideological structure, and the technological aspects of their community designs. Bert Salwen, a New York University archaeologist, has had a longstanding interest in the behavior patterns of our own society. His research has included the correlation of supermarket merchandise and neighborhood contexts in different ethnic areas of New York, studies of "territorial" and "cooperative" behavior among students in NYU dormitories and the effects of different kinds of behavior on the spatial arrangements of dormitory furniture, and even studies of differential vandalism in New York public facilities.

The most famous of these studies is the "Garbage Project" conducted by researchers at the University of Arizona. There, garbage from a controlled sample of neighborhoods in Tucson is systematically collected and inspected. The idea behind the project is to systematically relate economic behavior at its most basic level, i.e., products acquired and consumed—in other words, trash, to various aspects of American culture in this particular region.

So archaeologists are not merely interested in the most remote past of peoples, but rather in the ways that society operates at different places and times, and the relationships that can be explicitly demonstrated between the technological and economic remains of a society and the social and ideological structure of the human group composing it.

Recently we had the unique opportunity to study a small part of a modern phenomenon on the social scene in America, a small squatter camp in Hawaii that was an outgrowth of what has popularly been called the "hippie movement."

The opportunity came during the summer of 1978 when the University of Hawaii-Honolulu and the University of Illinois at Urbana-Champaign conducted a joint archaeological field school at Ha'ena, the northernmost point on the island of Kauai in the Hawaiian chain. The archaeological field research was designed to study various aspects of land use at Ha'ena over time. Our primary emphasis was on the prehistoric Hawaiian settlement there.

Ha'ena is a rich archaeological complex with a large occupation of the beach area, extensive irrigated taro terraces, some of them buried under tons of storm borne sand, house platforms, enclosures, and old *heiau* or temples. It is also the site of Taylor Camp, a self-styled hippie community that began in 1969 and lasted until its residents were evicted in 1977. Since Taylor Camp can be considered the last major adaptation to the Ha'ena area (it is now being proposed as a state park), it was a legitimate area of study for our research team. During the summer we conducted

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*Mount Makana, on the island of Kauai, stands behind the site of Taylor Camp at Ha'ena, in the foreground. Taylor Camp residents dubbed the peak "Buddha Mountain."*

some limited mapping, surface collection, and excavation in the ruins of the camp. We also interviewed former residents of the community as well as local Ha'ena people who had watched from the outside as the community developed, prospered, and finally met its untimely end.

The research that we began last summer is far from complete, but it gives an interesting picture of life in a particular hippie community in the 1960s and 70s. We were concentrating on the settlement patterns at Ha'ena over time, *i.e.*, how people distributed themselves across the landscape, and subsistence, the way they supported themselves from the land (and in the case of Ha'ena, from the sea).

In most societies settlement and subsistence are closely related. People choose to live close to where they hunt, plant, or for that matter work at a 9 to 5 job. This was certainly the case with the Hawaiian settlements, historic as well as prehistoric, that we excavated at Ha'ena. Most of the native Hawaiian sites that we recorded were behind the Ha'ena beach and just below some of the large agricultural complexes near the two major streams in the area. The Hawaiians who settled at Ha'ena Point sometime before A.D. 1200 were placing their settlements in between the two mainstays of their economy, the sea with its rich protein resources on the one side and the large irrigated gardens on the other.

The Taylor Camp occupation contrasted markedly with this Hawaiian pattern. This may have been partly due to the series of events that led to the founding of the camp, but more importantly it was due to the kind of economy that supported the people living at the site.

Taylor Camp was not a planned community. The land on which it was built had been loaned for use by Howard Taylor, a Kauai resident, to a small group of people (estimated at from 17 to 22 souls) who had been squatting at several of the county parks on Kauai during 1968 and 1969. The county police had shooed the group from one park to another and the county was taking legal action against them when Mr. Taylor offered them the use of a small parcel of land bordering the beach at Ha'ena Point.

Taylor Camp began with a series of tents, but quickly transformed itself into a set of more permanent structures as tents rotted and the inhabitants saw some possibility of permanent residence on the land.

By 1972 there were 21 permanent houses at Taylor Camp. All of them were tree houses since local authorities would not issue them permits for ground dwellings. Some of these structures were quite elaborate indeed, with large bamboo pole foundations, clapboard siding, and windows facing the sea. In addition to the houses in the camp there was a communal shower, an open air

toilet, a small church, and even a cooperative store which operated on and off until the camp's closing.

The community had grown in size as well as in structural permanence, and the estimates of population that we have obtained from informants centered around 60 or 70 persons including children.

Because Taylor Camp was not a planned community, there was no consistent theme to its growth, but the camp's size was artificially curtailed when Mr. Taylor, under subtle coercion from the community, asked that no more houses be built on the land.

*Four contiguous 2x2 meter squares in Taylor camp occupations cut through historic trash deposits to the Native Hawaiian occupations below.*

The limits of Taylor Camp's growth put certain stresses on the community, but also permitted the development of a permanent structure to the settlement. The best and most substantial houses were next to the beach. About 50 meters back from the beach were several other houses constructed on the long-abandoned irrigated taro terraces. A community trail bisected the camp and led back through a parking lot area to the Kuhio highway, the main road that connects the north end of Kauai to Hanalei, the nearest town some seven miles to the east. The church appears to have been located on the west side of the camp close to the cooperative store. Near what must have been the center of the camp was the communal toilet, an open air "throne" mounted next to a concrete septic tank (a requirement of the local Department of Health) as well as the shower, a contraption ingeniously rigged from 55 gallon oil drums. A special attraction of Taylor Camp was the sauna constructed sometime before 1972 near the beach on the east boundary of the community. On the west side of the camp were the gardens, about two acres in extent, which are still producing a few vegetables today.

What primarily interested us was how the inhabitants of Taylor Camp supported themselves. The placement of the community in such a remote area of Kauai seemed to leave two options open to community members. The first was to attempt to establish a local resource base very much like the native Hawaiian subsistence that we had noted from our excavations at other localities in the Ha'ena area. The second option was to tie the support of Taylor Camp into the local cash economy of Kauai. It seems that the majority of Taylor Camp residents chose the latter option, although an informant survey that we conducted as part of our research produced a wide range of opinion about the economy of the camp and the way that its residents supported themselves.

Many local Ha'ena residents claimed that the economy of the camp was based on welfare support from county and state and on the production and sale of *Cannabis sativa*, which Hawaiians call *pakalolo* ("crazy weed") and we often call marijuana.

One of our informants who had lived in the camp from 1972 until it closed disagreed. He

stated that Taylor Camp was like any other community in the U.S. The majority of its residents worked at various jobs on Kauai and considered the camp an inexpensive and comfortable place to live. Some grew *pakalolo* for sale or home use, and a few were on welfare. But according to this informant there were no more people supported by welfare in Taylor Camp than in the community at large.

Another resident who had lived there for the last two years of the camp's existence seemed to contradict our first informant. He claimed that you could tell when the welfare checks came in because "everybody was drinking Heineken's." He also claimed that the camp was in his words "wired to Ching Young's store." Ching Young's was the local general merchandiser located in Hanalei.

Our initial research at Taylor Camp tells us little about whether the camp was dependent on "welfare" or foodstamps for its maintenance, but it does support the view that it was "wired to the general store." Two massive trash pits were located in the garden area to the west of the camp. These were filled with glass and metal trash, all of which reflected a heavy dependence on the cash economy of our own society. Several smaller trash pits in the camp were filled with commercial containers for everything from spices to tinned luncheon meats. The small amounts of garbage that we collected from the upper levels of the site in the course of our excavations into the earlier Hawaiian components showed little or no use of resources such as the local limpet called *opihi*, or strombus shell. These shellfish are abundant in the area today and appear to have been among the chief inshore resources used by the earlier Hawaiian settlers at Ha'ena. Taylor Camp residents, however, don't seem to have had an interest in the resources of the sea.

Our excavations in one particular 2×2m square at the site produced an interesting contrast in economy. The deep Hawaiian layers here produced thousands of grams of garbage, including shell, fishbone, pig and dog bone and even fish scales. A pit from the Taylor Camp period, on the other hand, yielded rotten tent fabric, metal grommets, a tab top from an aluminum beer or pop can and an empty tin of sardines that had been packed in Maine.

The small size of the garden area—a little less than two acres—demonstrates that planting played a secondary role in the subsistence of Taylor Camp residents.

The large amounts of metal and glass trash, and the fact that the garden area of the camp, even during its most intense planting, couldn't have supported even one-fourth of the residents of Taylor Camp, both suggested to us that the camp, despite its isolation, had to be dependent on a traditional American cash economy.

Besides these, a major sign of the dependence of Taylor Camp on the outside is the number of abandoned cars that still pepper the landscape at the margins of the main camp. We counted at least 26 cars, most of them stripped of usable parts. The vast majority of these vehicles, if we can believe our informants, were left behind by Taylor Camp residents. Most were older models that had apparently died natural deaths in the camp parking lot. We were told by one former camp resident that if a car died even temporarily "it was a goner." It would be stripped of most usable parts by other camp residents and local outsiders in order to keep their own cars running. A working automobile was a valuable asset since it provided access to the general store as well as mobility for those who either worked in conventional jobs or grew their *pakalolo* in isolated areas far removed from the camp.

The sheer number of these vehicles within the confines of the camp leads to the inference that Taylor Camp was almost completely tied in with the cash economy of the island. The importance of automobiles in Taylor Camp, as isolated as it seemed to be from the rest of Kauai, reflects the importance of automobiles to American society at large. The residents of the camp shared an American need for mobility. They do not seem to have rejected the earlier Hawaiian lifestyle represented in our excavations there so much as they were unaware of the potentials that the sea and the land offered them.

Several of the informants that we talked to who were residents of the camp stressed the idea that they considered themselves to be living close to the land while they were at Taylor Camp. The archaeological remains that we mapped and uncovered there suggest to us that their perceptions of being close to the land included isolation from the main centers of trade and commerce on Kauai rather than dependence on the land for subsistence.

Taylor Camp was a somewhat bizarre settlement in the eyes of the local residents of Ha'ena. Its residents often sunbathed in the nude, and some preferred to go about their daily activities without benefit of clothing. Their church, called the Church of the Brotherhood of the Paradise Children, welcomed Christian, Buddhist, Jew, and atheist alike. Worshippers shared experiences of God, the sun, or the mystical power of the pyramids. There were no police in camp and community members attempted to maintain order by good judgment, common sense, and community meetings.

Taylor Camp was altogether unlike the outside community in its lack of bureaucratic structure. While the size of the community was constrained by the number of structures, there was a large transient population associated with the camp. These visitors stayed sometimes for a few days, and often for longer periods. A few of them managed to become community residents as

*Historic trash pit cuts through natural sand stratigraphy at Taylor Camp, intruding into ancient buried taro terrace at its bottom. This trash pit produced tent fabric, grommets, and a can for Maine sardines.*

older members left and "willed" a transient or friend from the mainland a house or a room in one of the spacious treehouses.

The large number of mainland visitors to the sparsely inhabited north end of Kauai, the lack of participation of camp members in community affairs and structures, the nudity, and of course the presence of "drugs" all contributd to the suspicion with which the older, more fixed residents of Ha'ena viewed Taylor Camp.

At the same time, our initial excavations and survey there suggest to us that Taylor Camp was well within the mainstream of the American value system. A tremendous value seems to have been placed upon mobility in the form of the automobile. The subsistence of the camp was based on a cash economy that required considerable monetary inputs rather than on a regime of planting and fishing. In terms of its support system at least, the camp was little different in orientation from the farflung bedroom communities of the large metropolitan centers of America.

There were, of course, certain major differences. The residents of Taylor Camp were apparently younger than the average middle class suburbanite, and it is likely that they had smaller and fewer families to support. But like most American suburbanites they chose a lifestyle that was comfortable to them and then went to considerable pains to maintain it, even though it meant long treks for work, shopping, and leisure activities. There is little doubt that the form that Taylor Camp took would have been impossible without the automobile, and that cash, whether derived from the illicit sale of drugs, welfare fraud, or hard labor played an important part in the success of the community.

Taylor Camp was an experiment in living in the late twentieth century that was spawned by an attempt at rejection of many of contemporary America's superficial values. But it was an experiment in alternative leisure styles rather than a Utopian settlement designed to explore the economic and organizational frontiers of human settlement. It existed within a fixed and commonly accepted value system that emphasized mobility and depended on a cash economy. Its history and growth can give us some new insights into the way that frontier communities develop in the twentieth century within our own cultural matrix and the basic value systems of a number of people in our society who attempted, for a variety of motives, to develop their own community structures and living styles.

The camp is interesing to the archaeologist because it provides a setting to explore how closely the alternative lifestyles developed at a particular point in American history were tied into the economic and social matrix of the society at large. The externals of the camp—the church, nudity in everyday activities, etc.—placed the camp and its residents well outside the mainstream of rural American life on the north shore of Kauai. From the archaeologist's point of view, however, there was a vast sharing of basic economic and social values between Taylor Camp and the surrounding community. Taylor Camp and communities like it may help explain this pattern of ambivalence—the mosaic of acceptance and rejection of items, economic base, and social values by a large number of people in America during the late 1960s and into the 1970s □

# OUR ENVIRONMENT

### Time of Death Can Be Set for Deer

The Utah Division of Wildlife Resources has developed a technique for determining time of death in a deer. The technique could be valuable in prosecuting poaching cases.

What's involved is analysis of the vitreous humor, the fluid between the retina and lens of the eyes. While the deer is still alive the potassium level in the blood and eye remains equal. At the time of death, the vitreous humor begins to absorb potassium at a constant rate. It goes from 130 parts per million at death to 1,000 ppm after the deer has been dead for 108 hours. Similar techniques have been used to pinpoint time of death in humans to within a half hour.

### Hunting Doesn't Affect Mallard Numbers

Research has shown that as long as hunter harvest of mallard ducks is below an unspecified critical level the same number of birds will die each winter regardless of whether they were hunted or not.

Utah State University researchers and the U.S. Fish and Wildlife Service recently concluded a study which found that mallard survival did not increase during years of hunting restrictions. Hunting at the rate of past years apparently did not alter survival rates for the ducks. Death from natural causes cuts into surplus birds.

### China Tops Billion

The 1978 report of the Environmental Fund, a Washington-based private group with a high reputation for accuracy, puts China's population at 1,003,900,000.

Then come India with 656 million, the USSR with 261 million, the US with 230 million, Indonesia with 149 million, Brazil with 122 million and Japan with 115 million.

The fastest growing country is the United Arab Emirates at 8.9 percent, followed by Kuwait at 5.9 percent and Libya at 4.1 percent. One surprise is that China is reckoned to be growing faster than India: 2.3 percent as against 2.1 percent. Not far behind (another surprise) comes the US with 1.7 percent. But almost half this figure is accounted for by illegal immigrants, mainly from Mexico.

World population is estimated at 4,365,300,000 — an increase of 59 million on last year. (Other estimates put the increase at 70 million to 80 million.) In other words the global population, despite a slight easing off in the rate of climb, is continuing to grow every year by more than the population of the United Kingdom, one of the planet's more overcrowded countries.

### EPA Suspends Use of Herbicide 2,4,5-T

In a very unusual action, EPA has declared an immediate halt to most uses of the herbicide 2,4,5-T and its closely related counterpart, silvex.

The decision to suspend use of the herbicide was based on animal test results and the high level of miscarriages among women in the Alsea Basin area of Oregon, shortly after the chemical was sprayed there.

While the major use of 2,4,5-T in the Midwest is along power line rights of way, consumers and homeowners may have silvex products around the house for lawn care use. The EPA warns that existing stocks should be secured safely out of reach and in accordance with storage instructions on the products' labeling until the agency issues a final order after expedited suspension proceedings conclude. The distribution, sale, or use of a suspended pesticide is illegal, and could result in stiff penalties.

The emergency suspension was necessary because the spring spraying season was scheduled to begin soon, and an estimated four million people nationwide could have been exposed to the herbicides. The suspension applies to use of 2,4,5-T in forests and pastures, and along power lines and highways. It also applies to silvex, a weed killer used on lawns. Use of these herbicides is permitted on rice fields and on sparsely populated rangeland, where there is less human exposure.

### Federal Grants for Waste Recovery

Eleven midwestern cities are now eligible for grants to develop resource recovery projects. The grants program, part of President Carter's Urban Policy, will provide funds for feasibility planning, financial arrangements, and market studies for projects such as recycling of paper, glass, and aluminum, or recovery of energy from solid waste.

The eleven cities selected are: Chicago, Rockford, Indianapois, Detroit, Flint, St. Paul, Cuyahoga County (Cleveland), Montgomery County (Dayton), Toledo, and Wausau/Stevens Point. These communities will share the $15 million program with 57 other areas across the country.

### "Mouse Magnets" Called Useless

The February *Bulletin* (p. 22) reported that a California firm was marketing a device "capable of making sound so shrill that it drives rodents wild, kills cockroaches, and sends fleas flying." Since publication of that information, however, the editor has been apprised of tests demonstrating that such devices are less than effective. The following study was reported in *Bioscience* (Feb. 1979, Vol. 29, No. 2):

"The legendary 'better mouse trap' still hasn't been built, say two biologists at the University of California at Davis. Under an EPA grant to study manufacturers' claims that electromagnetic devices successfully control rodent populations, vertebrate ecologist Rex Marsh and wildlife biologist Walter Howard found the devices worthless. 'Rodent-proofing traps, and rodenticides still are the best,' they say.

"Manufacturers of the devices claim that the influence of modified low-level electromagnet fields can so disturb a rodent's nervous system that the animal cannot eat, drink, or reproduce. Eventually, it starves to death. But Marsh and Howard found otherwise. Their tests showed no difference in food and water consumption between wild house mice and common Norway rats exposed to the devices, and those that served as controls.

"Howard and Marsh tested 80 rodents. Their results confirmed earlier field tests on pocket gophers in San Bernardino County and mice in egg ranch housing structures, as conducted by the U.S. Cooperative Extension Service. 'There is little scientific evidence that low level electromagnetic fields, as used in these devices, could in any way be used effectively for rodent control,' they conclude. But there is evidence that high levels could be dangerous to animals including man.' "

The editor has received no additional information concerning the effectiveness of ultrasonic devices on insect pests.

## Uranium-Mining Residues: A 100,000-Year Headache

What do Edgemont, South Dakota; Shiprock, New Mexico; and Durango, Colorado have in common? Located in these western towns are sites that contain the only remaining vestiges of now defunct and dismantled uranium mills: millions of tons of radioactive residue, piled high on acreage that is often bordered by residential communities.

Uranium mill tailings sites remain at the more than 20 locations where uranium was once milled and used to produce high-grade uranium, or yellow-cake, for U.S. defense programs and the Atomic Energy Commission (AEC). Many of the companies that once mined the uranium in the 1950s and 1960s have since folded, but their operations left more than 27 million tons of radioactive residue at numerous sites, most of which are located in the western part of the country. For many years, no one paid attention to the mill tailings piles, nor their possible effects on the surrounding community and environment. The former AEC was responsible for the tailings, but management was virtually nonexistent; not until the late 1960s did the commission acknowledge that the tailings might pose a significant health hazard. Indeed, in 1959 the AEC authorized several mining companies to sell mill tailings to construction companies for use as fill material, but in 1966, some astonishing and disconcerting evidence turned up: more than 700 buildings in Durango and Grand Junction, CO, and numerous other places were contaminated with radiation from the use of tailings as fill.

Subsequent studies and roused public concern over the health effects of the radioactive residue have led to the determination that the tailings problem merits immediate resolution and is indeed more complicated and hazardous than previously thought. Last year, a Salt Lake City consulting firm, under contract to the Nuclear Regulatory Commission, published the results of extensive studies on the 22 inactive tailings piles in the country. The study listed five ways in which the population can be exposed to radiation from the tailings sites.

The major exposure, and greatest hazard, is associated with the inhalation of radon gas and radon "daughters," which are decay products of the radium contained in the waste. Since the tailings are usually exposed in huge, uncovered piles, they may exude radon gas at up to 500 times the natural background rate. These products are alpha emitters and are known to be associated with lung cancer. Moreoever, radon "daughters" are heavier than air and so can accumulate and remain in buildings for long periods of time. The study concluded that the cancer risk was double for persons living within about a half-mile of piles such as a 1.9 million ton, 128-acre pile in downtown Salt Lake City.

The second kind of exposure from the tailings is gamma radiation. Gamma rates drop off sharply beyond several tenths of a mile from the tailings, but remain at least twice background rates where windblown tailings have drifted. These windblown piles are the cause of a third type of exposure: inhalation and even ingestion of radium and thorium, both alpha emitters. In towns such as Edgemont, SD, all the 2,000 inhabitants are continually exposed to tailings which blow into homes, schools, and businesses from the pile just west of the town. Part of the pile has even invaded the backyard of an adjacent home.

The study outlined a fourth possible type of exposure: water contamination. Radium-laced water leaching from the pile into the groundwater can end up in a town's drinking water and cause further harm to the population. Finally, the study notes that uptake of radioactive elements by plants and animals and subsequently consumed by humans, can be another source of internal radiation. A tomato plant grown near the pile in Edgemont showed a radium concentration, and an area east of the old mill is cattle-grazing land.

Slowly but surely, the grim data about the health effects of the radioactive piles are coming in. A South Dakota state health department report shows a higher rate of cancer in Fall River County—where Edgemont is located—than in any other county in the state. Most of the increased deaths were caused by respiratory cancer, exactly what would be expected from radon inhalation. In the sleeping quarters of Salt Lake City's Fire Station No. 1, which was built on radioactive mill tailings over 20 years ago, it was found that the exposure to radon daughters is fully seven times greater than that allowed for uranium miners. Other disconcerting stories will undoubtedly arise in the near future, as roughly 15-20 years pass before the appearance of cancers associated with radiation exposure show up.

Clearly, the radioactive waste problem is a large one, and one that is here to stay. In addition to the 27 million tons of wastes at the abandoned sites, over 113 million tons have accumulated at active sites. Estimates show that a billion tons of tailings could be produced by the year 2000 if uranium is milled at the current rapid pace. Further, a finding in a report issued by the American Physical Society in 1977 grimly states: "For long-term waste management, the hazard associated with radium is more significant than that for plutonium [found in spent fuel rods from nuclear power plants and in high-level waste from fuel reprocessing]. In addition, for regional population exposure, radionuclides in uranium mill tailings are potentially at least as important as the actinide elements in high-level waste; the relative accessibility of mill tailings contrasts with the isolation proposed for other actinide-containing wastes."

Last fall, the uranium mill tailings problem reached the halls of the U.S. Congress, where a debate raged over who should pay for the tailings cleanup. The states involved—among them Colorado, Utah, New Mexico, and Wyoming—argued that the tailings were created by processing uranium for the federal government's nuclear weapons program, thus they should not have to pay for the cost of cleanup. The Carter administration backed a measure that would require the federal government to pay 75 percent of cleanup costs and the state governments 25 percent. The bill that was finally enacted in the closing hours of the 95th Congress provides for the federal government to pay 90 percent of the conservative cleanup estimate of $140 million, with the states footing the other 10 percent of the bill. The legislation also strengthens the licensing and management authority of the Nuclear Regulatory Commission (NRC) to ensure proper tailings management by current uranium milling operations.

A generic environmental impact statement (GEIS) on tailings disposal is scheduled to be released by the NRC sometime this spring, with recommendations for the future management of uranium mills and ways to reduce the current radiation levels at the inactive sites. The NRC is currently requiring active uranium mills to regrade the waste piles—in order to resist erosion—and then cover them with about 8 to 12 feet of clay and other soil to meet the objective of reducing radon levels to twice background levels. Long-term plans for disposal of the tailings—which will release radon for more than 100,000 years—will be the topic of much discussion and debate this year when the GEIS is released. — *Patricia Weil, National Wildlife Federation.*

### Arctic Haze Studied

Climate specialists at an international conference in Geneva, Switzerland, have reported that smog and dust from Europe and China may explain a puzzling haze that visits the atmosphere of Alaska, Greenland, and the Arctic Ocean each spring. Climate experts and meteorologists from 40 nations, discussing the arctic haze at the recent meeting, said it contains sulfate particles, produced from burning high-sulfur fossil fuels, traces of vanadium and silicates. Some of the particles were probably blown north from the industrial regions in Europe, while others may have originated in the Gobi Deserts of China and Mongolia. A similar haze also has been reported at the South Pole; scientists are still seeking further explanation of the phenomenon.

### Winners in Dirty Air Contest

Most environmentalists can guess which U.S. city has the worst air quality. Los Angeles, famous for its smog, was the easy "winner" in a study published by the Council on Environmental Quality. On 318 days in 1975—the year on which the study was based—its air was "unhealthful," "very unhealthful," or hazardous."

But the list of a representative group of cities contained a few surprises, according to the National Wildlife Federation, which monitors the nation's air pollution in its annual Environmental Quality Index report. The cities, and the number of days on which their air was "unhealthful" or worse were: Denver, 177; Albuquerque, 150; Philadelphia, 150; New York-New Jersey Metropolitan Area, 149; Boston, 147; Houston, 141; St. Louis, 140; San Francisco, 127; Spokane, Wash., 126; Phoenix, 118; Fairbanks, Alaska, and District of Columbia, 90; Sacramento, Cal., 88; Louisville, Ky., 72; Steubenville, Ohio, 60; Cincinnati, 51; Omaha, 40; Memphis, 38; and Wichita, Kan., 25.

### Fighting Pests with Pests

Insect pests cause considerable trouble, destroying crops and carrying disease. But the chemical poisons used to kill them can be just as harmful to the air, water, and people.

There is a safer, more natural way to control insects according to "Fighting Pests with Pests," just published by the National Wildlife Federation, located in Washington, D.C. The pamphlet is designed to show children why more and more farmers in the United States are using the natural enemies of pests instead of harmful chemicals to protect their crops.

This new method is called "pest management" and relies on the "three Ps" — insect predators, parasites, and pathogens. "Someday pest management may make most poisons unnecessary," the eight-page illustrated pamphlet suggests.

Included in the publication is a chart that lists 34 common insect pests and natural ways to control them. For example, chinch bugs can be kept away from corn by planting soybeans nearby as a "trap plant."

### Sex Change in Fish

Many fish species are capable of making a complete sex change while adults. One of the speediest examples is the Pacific wrasse. After a two-year study on the Australian Great Barrier Reef, researchers have documented such changes which take only two weeks. Male wrasses guard territories with

harems of from three to six smaller females. If the guardian male dies, neighboring males try to take over. If the dominant female is able to rebuff the males she will begin to change her sex from female to male within less than one hour of the death of the original male. Within two weeks the change is complete and the new male is capable of producing viable sperm.

Such a sex reversal seems to be controlled socially. Each male controlling a harem supresses the subordinate females' tendency to change sex by actively dominating them. Males are produced only when a fish can successfully establish itself as a harem owner.

### The White Whales of Manitoba

The story of twentieth-century whaling in Hudson Bay is one of use combined with scientific study; both ongoing with interrelated goals. The changing role of man and his impact on the arctic is reflected in changing attitudes towards the beluga, or white whale. No longer extensively hunted, beluga populations today appear both stable and healthy.

In 1931 the Hudson's Bay Company whaling operatings were closed down and from 1931 to 1949 hunting was confined to local residents and missions. Whale meat was used mainly as dog food. The beluga fishery came under the control of the Federal Department of Fisheries in 1949. Shortly after, the Adanac Whale and Fish Products Company moved into Churchill. Inuit, Cree, White, and Metis residents purchased licences for $1.00 to hunt beluga and were paid by the foot for each whale caught.

The whaling season was relatively short, lasting from mid-June to late September. Two men in outboard canoes formed hunting teams. The bowsman-harpooner located the whales and signalled the helmsman during the chase. The oil was sold to commercial companies for use in margarine, lubricating fluid, soap or cosmetics. The liver was made into animal food and the steaks were sold in Winnipeg stores for human consumption. The carcass and bones were ground into 50-pound packages for dog food and fur farms, while the hides were made into leather.

This fishery flourished throughout the 1950s with an average annual catch of 450 whales. It was revived in 1964 after a short period of decline and in 1965 Churchill Whale Products Limited took over operations. By now industry was using the oil extracted from the top frontal portion of the beluga's head to lubricate fine watches and scientific equipment. This oil sold for $15 a gallon. Other oil was used in margarine which sold at 90¢ a gallon.

In 1965 a local Whalers' Association was formed, but the processing plant was already in serious financial trouble. Constant equipment breakdowns and the closure of mink farms in Manitoba were contributing factors. Then, with the assistance of the Federal Department of Cooperative Services, a local co-op was formed. The plant operated successfully for two seasons before mercury contamination and a decline in commercial sales finally resulted in its closure in 1968.

The Beluga Protection Regulations administered by the Federal Department of Fisheries also became law in 1965. Under this law, sport whale hunting was encouraged, but hunters were required to hire local Indian or Inuit guides. A quota was placed on the number of whales harvested and the amount of meat hunters were allowed to take home. Today beluga hunting is limited to local residents of the Canadian Arctic.

A tagging program which lasted two years was started in July, 1967, by D.E. Sargeant of the Arctic Biological Station of the Fisheries Research Board of Canada. This was organized to learn more about the movement of beluga in the bay and whether different groups, or pods, intermingle or remain separate.

Tagging operations undertaken at the

mouth of the Seal River involved the hiring of experienced Indian whalers from Churchill. The canoes were formed into an arc and then the whales were eased slowly into the shallows. The men shouted, threw stones into the water or banged their paddles on the gunwales of the canoes in order to keep the animals from turning back. The whales were then jumped upon and lassoed at the head and tail with ropes. Tags were placed on the whale's back with a special pair of pliers. Other whales tagged in deeper waters were harpooned with a special harpoon having a head which could be easily withdrawn after each hit, leaving behind a tag sunk into the hide of the animal, with an attached plastic sleeve on which was stamped the Federal Department of Fisheries address.

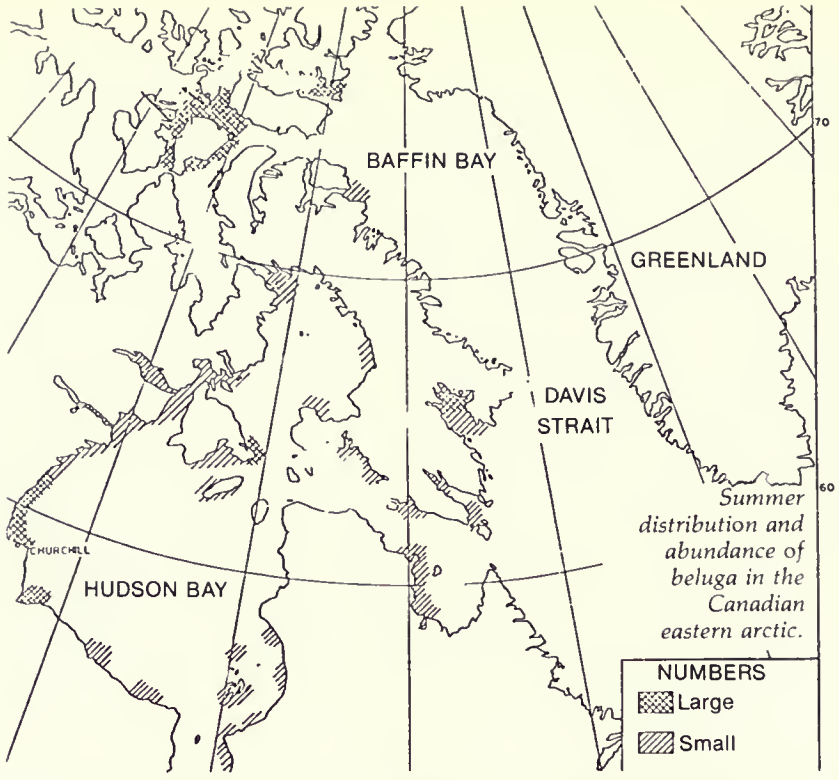
Live whale capture techniques were developed in Churchill. In 1966, "Marineland of the Pacific," hired boats and motors from the Churchill Whalers' Co-op to capture white whales for their aquarium. The Seal River was selected for the capture, due to its abundance of whales and the clarity of the water. Attempts to capture beluga with cable hoops and nets proved unsuccessful. In addition, the prospect of transferring captured whales to a holding tank for a lengthy 14- to 16-hour trip from the Seal River to Churchill posed an unacceptable risk for the animals. The group returned to the Churchill River and tried again with nets, this time they were successful.

Techniques were learned by trial and error. The tried and true method used to capture beluga is similar to the cowboy's method of rounding up cattle from horseback. The capture team, riding in twenty-foot freighter canoes, locate a pod of whales. One beluga is selected for capture on the basis of its size and weight. This whale is then cut from the pod and driven into shallow water at the river's edge by "chaser" canoes.

Once the whale is surrounded by the canoes in the shallow water, a designated "jumper" dives near the front of the whale and secures the animal's head with a lasso. To prevent escape, a back-up jumper dives into the water behind the whale and immobilizes the beluga's powerful tail fluke which propels the animal. The captive beluga is then transported to a holding tank, cradled in a canvas stretcher which is attached to the gunwales alongside the boat. To offset the weight of the whale and prevent the boat from capsizing, several people must be seated on the opposite side of the canoe.

For the capture team, the most difficult part of the trip is the physical effort involved in restraining and carrying the half-ton whales while they're working in the icy waters of the Churchill River.

In transit, the safety of the whale is of primary importance. The canvas stretcher is slung beside the boat in a way which permits most of the animal's body to remain under water. To avoid the danger of drowning, care is taken to keep the whale's blowhole from submerging. To prevent sunburn and to protect the delicate skin from drying out, the beluga's back is covered with sheets of foam which are constantly moistened with water. The beluga are given a thorough medical examination by the veterinarians who are present at the capture.




*Summer distribution and abundance of beluga in the Canadian eastern arctic.*

A large holding tank located on the banks of the Churchill River becomes a temporary home for the captured beluga. The tank contains continuously circulating salt water from the river estuary, a natural medium for the beluga. The holding tank is lined with styrofoam and plastic to provide a comfortable temporary dwelling. Here the whales are allowed to rest and become relatively used to two new and frightening experiences — confinement and handling by man.

As soon as possible, the beluga are transferred to their new aquarium homes. Rapid air charters are arranged to transport the whales over international boundaries. Specially designed carrying crates have been devised to hold the whales on-board aircraft. Each of the beluga is moved individually in its own crate. Inside the crate, the animal is slung onto a mattress in a stretcher-like hammock. The hammock is supported by foam rubber and water. These foam-lined containers surround the whale, conforming to the natural shape of its body and providing a neutral buoyancy. These elaborate precautions are necessary to protect the whale because the skeleton of this marine mammal lacks the strength to support its own weight out of water. Without proper support the beluga's lungs will collapse. Ice packs and water inside the crate maintain normal body temperature and special sprayers keep the skin moist during the flight.

The Beluga Whale Live Capture Program is now run by Nanuk Enterprises in Churchill. Since 1972, beluga from the Churchill River have been captured for Canadian and international zoos and aquariums where they afford visitors an opportunity to study and observe these mammals as never before. Whales have been successfully transported to aquariums in Dusseldorf, West Germany; Coney Island, New York; Minneapolis, Minnesota; and Kamazowa, Japan.

Beluga often do not resume feeding for two weeks after they arrive at the new aquarium, and the fasting period has been observed to be as long as two months. An appetite-stimulating drug is administered by some receiving aquariums. However, aquariums report that the beluga adjust quickly to their new surroundings, becoming friendly and apparently enjoying contact with their human trainers and keepers.

But there is still much that we do not know about this gentle white whale. Not only is there much that needs to be understood, but there is much that beluga can teach us about environmental adaptation — especially in the arctic. Such lessons may have profound meaning as man exerts greater influence upon the arctic region with each passing year. — *Manitoba Department of Mines, Natural Resources and Environment.*

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*Publication of this report in the* Bulletin *on the hunting and capture of the white whale constitutes neither an endorsement nor disapproval of the activity. Its appearance here is for informational purposes only.* — Ed.

# June and July at Field Museum

*(June 15 through July 15)*

### New Exhibits

**"Treasures of Cyprus."** Opened June 14. These 150 objects reflect nearly 8,000 years of Cypriot art and culture. Situated at the crossroads of three continents—Europe, Asia, and Africa—the Cypriot people have kept their individuality while still assimilating other cultures. The bowls, jugs, vases, religious idols, and jewelry show the influence of many peoples while remaining typically Cypriot. This is the show's last stop before returning to Cyprus. Because of the extreme age and fragility of the objects, this exhibition will not travel to the United States again. Through September 16. Hall K. "Treasures of Cyprus," developed by the Smithsonian Institution Traveling Exhibition Service (SITES), is sponsored by the government of Cyprus and organized by Vassos Karageorghis, director of the Department of Antiquities, and Patroclos Stavrou, undersecretary to the president of Cyprus. See story on page 4.

**Cypriot kylix,** or drinking cup, of Cypro-Geometric III period (850-725 B.C.). Height 20 cm (7.9 in.). Photo courtesy Smithsonian Institution.

### Continuing Exhibits

**"Art Lacquer of Japan."** Opened May 9. Features *inro* (intricately carved and decorated sectional medicine cases), *netsuke* (tiny carved pendants), and *ojime* beads, which hung from the waists of 18th- and 19th-century Japanese men as symbols of wealth and status. Planned in conjunction with "Japan Today" festivities, this is the first Japanese exhibit installed at Field Museum in 50 years. Miniature landscapes, dreamlike still lifes, and mythic dragons are flawlessly carved into lacquer ornaments no larger than a matchbox. Examples of Chinese lacquer art will be exhibited for comparison. Hall 32.

**"The Art of Being Huichol."** Opened May 5. A major traveling exhibition of more than 150 objects of Huichol Indian art. The exhibit was organized by the Fine Arts Museums of San Francisco and is sponsored by a grant from the National Endowment for the Arts and by the Museum Society of the Fine Arts Museums of San Francisco. The exhibit includes costumes, votive objects, weavings, embroidery, beadwork, and yarn "paintings." The "art of being Huichol" is the act of living a devout life, and spiritual themes dominate their art. The Huichol also value visionary experiences produced by the hallucinogenic peyote and these images are reflected in their dramatic yarn paintings. The Huichol live in an isolated area of Western Mexico, and they remain one of the few traditional Indian groups whose ancient beliefs and practices remain unchanged even today. Through September 3. Hall 27.

**"Feather Arts: Beauty, Wealth, and Spirit from Five Continents."** Closes July 31. Last months to see acclaimed exhibit of 260 rare feather objects assembled almost entirely from Field Museum's own collections. Compare an intricate feather mosaic cloak from New Zealand with sophisticated Chinese jewelry inlaid with brilliant blue kingfisher feathers or with colorful feather adornments from South America's Indian tribes. Learn about the amazing structure of feathers and how they are used to express man's ideas about beauty, wealth, and spirit. After its closing here, "Feather Arts" will travel to three other museums across the country. Hall 26.

**"A Stamp Sampler: Postage from Natural History."** A one-case exhibit that combines 63 natural history specimens with samples of philatelic or stamp art. Planned on a rotating basis to cover the four disciplines of natural history, the first phase is devoted to zoological specimens and their images on stamps. Exquisite seashells and butterflies are among the specimens mounted with a leaping jaguar and fox in the second floor lounge. "A Stamp Sampler" was conceived by Col. M. E. Rada, exhibit guest curator, and was designed by Peter Ho, a University of Illinois graduate student.

**"Cash, Cannon, and Cowrie Shells: The Nonmodern Moneys of the World."** A fascinating collection that contains over 80 varieties of money used by ancient cultures. It explores the origins, values, and meaning of nonmodern money in terms of buying power for these past civilizations. The accompanying text gives the value of each form of money in terms of how much food it could then buy. Four general categories of moneys are on display: metal coinage, uncoined metal, shell money, and "miscellaneous," which includes food, fur, fiber, glass, teeth, and stone currencies. No closing date. Between Halls K and L, ground floor.

**Field Museum Gamelan.** Field Museum's 19th-century Javanese gamelan, an ensemble of 24 fine bronze and wood musical instruments, has been completely restored for exhibition. It is perhaps the finest gamelan outside Indonesia. Hall K, ground floor.

**The Hall of Chinese Jades** contains beautiful jade art spanning over 6,000 years of Chinese history. An exhibit in the center of the hall illustrates ancient jade carving techniques. Hall 30, second floor.

**American Indian Halls** trace the anthropological history and cultural development of the original Americans, from the time of their arrival on the North American continent (before 20,000 B.C.) to the present. Hall 5 contains a traditionally made Pawnee earth lodge—the home and ceremonial center of Pawnee Indians as it existed in the mid-1800s. Halls 4 through 10, main floor east.

**Tibetan Culture** can be explored in Hall 32, on the Museum's second floor. Rare film footage, shot in 1927, documents nomadic life and religious pageantry in Tibet. The Tibetan exhibits are divided into two sections. One hall displays common possessions from the past such as weapons, yak-herding equipment, and textiles. Lamaism, the Tibetan form of the Buddhist religion, is the theme of the second hall.

*(Continued on back cover)*

# June and July at Field Museum

*(Continued from inside back cover)*

**The Place for Wonder.** This gallery provides a place to handle, sort, and compare artifacts and specimens. Weekdays, 1 p.m. to 3 p.m.; weekends, 10 a.m. to noon and 1 p.m. to 3 p.m. Ground floor, near central elevator.

### New Programs

**"Chinese Folk Tales."** Sunday, June 17, at 11 a.m. and 2 p.m. Sunday, June 24 at 11 a.m., 1 p.m., and 2 p.m. The Laboratory Company of Body Politic Theatre uses mime and improvisation to bring alive traditional Chinese folk tales. The program is suitable for young people and families. Members: $1.50; nonmembers: $3.00. Lecture Hall II.

**"The Huichol Indians: An Historical Perspective."** Friday, June 22, at 8 p.m. James Simpson Theatre. With Basil C. Hedrick, assistant museum director of the Illinois State Museum at Springfield. In discussing the history of the Huichol Indians from the time of the Spanish intrusion until the 20th century, Dr. Hedrick describes the Huichol in relationship to other tribes. Topics include physical differences, geographical location, politics, religion, and customs. He also explores the tribe's interaction with the surrounding Spanish people. Members, $2.00; nonmembers, $3.50.

**"Huichol Contemporary Social and Economic Structure."** Friday, June 29, at 8 p.m. James Simpson Theatre. With Phil C. Weigand, associate professor of anthropology at State University of New York. Dr. Weigand, who has been doing field work among the Huichol since 1960, explains how this composite society of native Indian groups is reacting to the pressures of acculturation. The final program in a series planned in conjunction with "The Art of Being Huichol" exhibit. Members, $2.00; nonmembers, $3.50. An optional Members' dinner (for $7.50) precedes the lecture at 6:30 p.m.

**"Summer Fun: Field Museum Workshops."** A series of workshops for young people ages 6 through 12 will highlight many of the interesting museum exhibits and give young people an opportunity to become involved in diverse subject areas. Watch for the announcement of the July workshop series.

### Continuing Programs

**"Armchair Expeditions."** Geared for adult groups, these in-house "expeditions" include slide lectures and tours of selected exhibits. Dining arrangements available. Reservations are required. Call 922-0733 for more information.

**Summer Journey: "A to Z at Field Museum."** Self-guided tour leads families and children through a cross section of exhibits introducing them to the Museum's four main areas: anthropology, botany, geology, and zoology. Free *Journey* pamphlets available at the North Information Booth, and the South and West doors.

**Friend or Foe? The Natural History Game.** Field Museum's popular "Anthropology Game" has been expanded to include botany, geology, and zoology. The object here is to determine which one of apparently similar specimens is harmful and which is not. See if you can distinguish a vampire bat, a headhunter's axe, a poisonous mineral, or a deadly mushroom from its benign look-alike. Ground floor, no closing date.

**Medieval Cypriot glazed bowl.** A griffin is depicted on the inside. 15th cent. A.D. Diam. 16.5 cm (6.5 in.). On view in new exhibit "Treasures of Cyprus," opening June 14 in Hall K. Photo courtesy Smithsonian Institution.

**On Your Own at Field Museum.** Self-guided tour booklets, adult- and family-oriented, are available for 25¢ each at the entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

**Volunteer Opportunities.** Limited opportunities are available in botany, geology, and zoology. Weekend volunteers with an interest in natural history are needed to develop and present weekend programs. For more information call 922-9410, X 360.

**June and July Hours.** The Museum is open daily from 9 a.m. to 6 p.m. except Fridays. On Fridays, the Museum is open from 9 a.m. to 9 p.m. throughout the year.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at the reception desk, main floor.

July/August
1979

# FIELD MUSEUM OF NATURAL HISTORY BULLETIN

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of Natural History
Bulletin

July/August, 1979
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*Prairie lily (*Lilium philadelphicum *var.* andinum*), growing in Wolf Road Prairie, an 80-acre tract 15 miles west of the Chicago Loop. In northern Illinois the increasingly rare plant blooms from about June 11 to July 16.*
*Photo by John Kolar.*

# FIELD BRIEFS

### Loren P. Woods 1913-1979

Loren P. Woods, curator emeritus of fishes, died suddenly on May 13. He had been on the Museum staff from 1938 until last September, when he retired. Since then, he had continued his research activities at the Museum.

Woods' first Museum appointment was on the staff of the Raymond Foundation, which administers the Museum's public school programs. In 1941 he was made assistant curator of fishes and in 1947 was appointed curator, the position he held until his retirement. From 1947 to 1948 he was on leave with the United States National Museum, Washington, to study fishes collected in the region of the Bikini Atoll atom bomb tests.

Born and raised near Poseyville, Indiana, Woods did his undergraduate work at Earlham College, Richmond, Ind. (B.A. 1936) and graduate work at Northwestern University, the University of Washington, and the University of Chicago. He produced dozens of technical papers on marine and freshwater fishes during his career. His field work included numerous expeditions into Atlantic, Pacific, and Indian Ocean waters as well as to freshwater localities throughout North America.

*Loren P. Woods*

### New Membership Plan

Beginning July 1, 1979, a new annual membership plan becomes available to new and renewing members alike. Instead of being limited to a single class of annual membership, one will have the option of selecting an *individual* membership—whereby one person enjoys the benefits and privileges of the membership—or a *family* membership—whereby husband and wife and all their children living in the same household are beneficiaries of the membership.

The annual rate for the *individual* membership is $20.00 and that for a *family* membership is $25.00. Except for the new rate, the *family* membership is identical in all respects to the single annual membership plan that has been available in the past.

Current memberships are affected by the new arrangement only as they come up for renewal, at which time the renewing member may choose either the *individual* or the *family* plan.

*Life* memberships continue to be available at $500.00 (payable over a 12-month period). The privileges of this category, like those of the *family* membership, extend to husband and wife and all children living in the same household.

The new membership plan reflects only the second increase in membership rates since the Museum was founded in 1893; the first increase occurred in 1971. Since then, the costs of museum operation have risen markedly, necessitating the present increase.

### Raup Elected to National Academy of Sciences

David M. Raup, chairman of the Department of Geology, was elected a member of the National Academy of Sciences at its 116th annual meeting in April. He was among 60 new members chosen.

Membership in the prestigious academy is generally regarded as the highest recognition attainable for an American scientist. The election of Raup was based largely on his distinguished research in quantitative paleontology and evolutionary theory. He is the second staff member in the history of Field Museum to be so honored. (The first was herpetologist Karl P. Schmidt, 1890-1957, former chief curator of zoology.)

### Weekend Members' Tour to Galena October 12, 13, 14

Spaces are still open on Field Museum's fall weekend tour to historic Galena, Illinois, in the northwestern corner of the state. A century ago the small city was a bustling lead-mining center and many of the fine homes of that era are still preserved. Geologic features of the region continue to be of particular interest. Dr. Bertram G. Woodland, curator of petrology, who will serve as tour leader, will also provide commentary on the unusual geologic features of the area.

Accommodations for two nights will be at Chestnut Mountain Lodge. Price of the tour is $150.00 per person, double occupancy (singles on request). Included are all expenses of transportation on charter buses to and from Chicago; all meals and gratuities, except personal extras such as special food service. Advance deposit: $15.00 per person. For further information call or write Michael J. Flynn, Field Museum Tours, Roosevelt Rd. at Lake Shore Dr., Chicago, Ill. 60605. Phone 922-9410, ext. 251.

### Ellen Thorne Smith Bird and Mammal Study Center Dedicated

The memory of Ellen Thorne Smith, founder and first president of the Field Museum Women's Board, has been honored by the establishment of a bird and mammal study center at the Museum. Mrs. Smith, who died on March 16, 1977, was Women's Board president from 1966 to 1969.

The center, dedicated following the May 16 annual meeting of the Women's Board, has provided additional office and laboratory space for the bird and mammal divisions, consolidated the major part of the bird and mammal collections, and greatly increased the utility and security of the specimens. The center was made possible by a gift from Mrs. Smith's husband, Hermon Dunlap Smith, while Mrs. Smith was still living.

Also dedicated to Mrs. Smith at the May 16 meeting were two new bird habitat groups in Hall 20, the Greater Bird of Paradise and the Mallee Fowl groups. Establishment of the groups was made possible by donations from Mrs. Smith's children: Mrs. Walther H. Buchen, Mrs. John M. Haight, Mrs. John L. Simmons, and Mr. Farwell Smith.

In addition to Mrs. Smith's service as Women's Board president, she served for many years as a volunteer in the Division of Birds. From 1943 to 1945 she was, in fact, the Bird Division's sole staff, as the curators were on leave for wartime military service.

Besides her activities in the Bird Division, Mrs. Smith carried through several projects on her own. She wrote *Chicagoland Birds, When and Where to Find Them* (1958, 1972) and planned and supervised the preparation of the exhibit "Resident Birds of Chicago," selecting with equal care the birds and the plants that accompany them.

# El Niño: The Catastrophic Flooding of Coastal Peru

## A complex of oceanographic and meteorologic factors combine in one of Earth's most devastating, recurrent disasters

*BY* FRED L. NIALS, ERIC E. DEEDS, MICHAEL E. MOSELEY, SHELIA G. POZORSKI, THOMAS G. POZORSKI, *AND* ROBERT FELDMAN

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Along the western flanks of the Andes Mountains, from Peru into Chile, nature has juxtaposed a bleak and barren desert with a remarkably bountiful sea. As part of the Humboldt (Peru) Current, a narrow band of cold waters sweeps northward along the arid coastline, creating the richest marine habitat in the Western Hemisphere, if not the entire world. By 1970 this remarkable resource had enabled Peru to become the world's leading fishing nation, supplying more than one-fifth of the global marine harvest.

In stark contrast to the copious sea, the bordering desert is one of the driest places on earth, with a total rainfall for a quarter century of less than 45 mm. The landscape's austerity is broken by occasional streams and rivers fed by annual rains that occur high in the distant mountains. Long ago man began creating lush oases in the desert valleys by channeling these watercourses into large irrigation systems; these, in turn, were able to support productive farming the year round. The bounty of the sea, the bleakness of the desert, and the productivity of irrigation are all interrelated expressions of complex meteorological and marine currents that nature holds in a delicate balance.

Occasionally this balance loses equilibrium and the ensuing cataclysms can be staggering. The largest such disaster known is reported in this article. That event transpired about eight centuries ago; our story, however, begins more recently. As members of Field Museum's *Programa Riego Antiguo*, we are studying the rise and fall of irrigation systems in the Moche Valley on the north coast of Peru.* While we were exploring desert ruins in 1972, it suddenly began to rain—nature had lost equilibrium! For days erratic showers soaked, then saturated the normally parched landscape. With no vegetation to hold it back, runoff transformed dry washes and *quebrada* (normally dry ravine) channels into torrential streams. Flash floods cut all the northern highways, stranding not only the region we were in but the rest of the nation as well. Settlements were flooded, adobe

*Fred L. Nials is a geologist at Eastern New Mexico University who specializes in archaeological applications of geology. Eric E. Deeds is a Harvard senior who, as a PRA consultant, first identified the effects of the Chimu flood. Michael E. Moseley, codirector of the PRA, is associate curator of Middle and South American archaeology and ethnology at Field Museum. Shelia and Thomas G. Pozorski, codirectors of the PRA, are on the staff of the Carnegie Museum of Natural History, Pittsburgh. Robert A. Feldman is a research archaeologist with the Field Museum's PRA.*

*See also "Archaeology in the Electronics Age," by Robert A. Feldman and Alan L. Kolata, Field Museum Bulletin, July/August, 1978.

Fig. 1. *In the early morning hours of March 15, 1720, the Zaña River, in northern Peru, flooded as a result of niño rains, destroying the village of Zaña in less than four hours. The only reminder of the flood today is the massive erosion of the lower walls of this convent, now abandoned.*

houses collapsed, and mud choked down the life-sustaining canal systems. Accounts of the disaster, with its attendant death toll, appeared in newspapers around the world, but few readers realized that, as a consequence of the flooding, they would soon be paying higher food prices. Most of Peru's great marine harvest is rendered into fishmeal and oil used to feed people as well as livestock around the globe. With the rains came warm sea currents that scattered the vast schools of fish and inhibited their reproduction. The fishing industry came to a standstill. Thus, as the desert lay awash, the world lost access to one of its major protein sources. Nature had lost her balance and the cataclysm marked the return of *El Niño!*

Calamitous phenomena similar to those of 1972 had been recorded in recent historic times, such as in 1925 and 1891. The change from normal to abnormal conditions often began around Christmastime and, accordingly, came to be known by the Spanish term for the Christ Child, *El Niño*. Our study of the rise and fall of ancient irrigation systems recently led to the discovery of an *El Niño* catastrophe of a magnitude far greater and more devastating than all other such natural disasters striking the coast since the conquistadors first arrived in 1532. Transpiring about 1,100 A.D., this prehistoric niño was of unprecedented magnitude, and the devastation it wrought taxes the imagination of geologists and archaeologists alike. In order to fully appreciate the archaeological and geological evidence of this great cataclysm, it is first necessary to understand something of the nature of niños, characteristics of the Moche Valley, and of its prehistoric occupation:

## El Niño Conditions

"El Niño" lacks a precise scientific definition and its causal factors are still a matter of controversy. All significant coastal rains are products of niño conditions, yet not all niños produce rains. All niños, however, are associated with marine disturbances. Niños are said to occur when the trade winds diminish or stop, when upwelling of cool currents ceases, and when the sea and air warm to unusual temperatures. The ultimate cause of these abnormalities may be meteorological and relate to changes in the high pressure cell located over the southeast Pacific, which could influence the northward flow of the Humboldt Current.

Whatever their cause, niños are variable in intensity, and recurrent if not cyclical. Oceanographic records indicate marine disturbances in 1925, 1930, 1939, 1941, 1943, 1951,

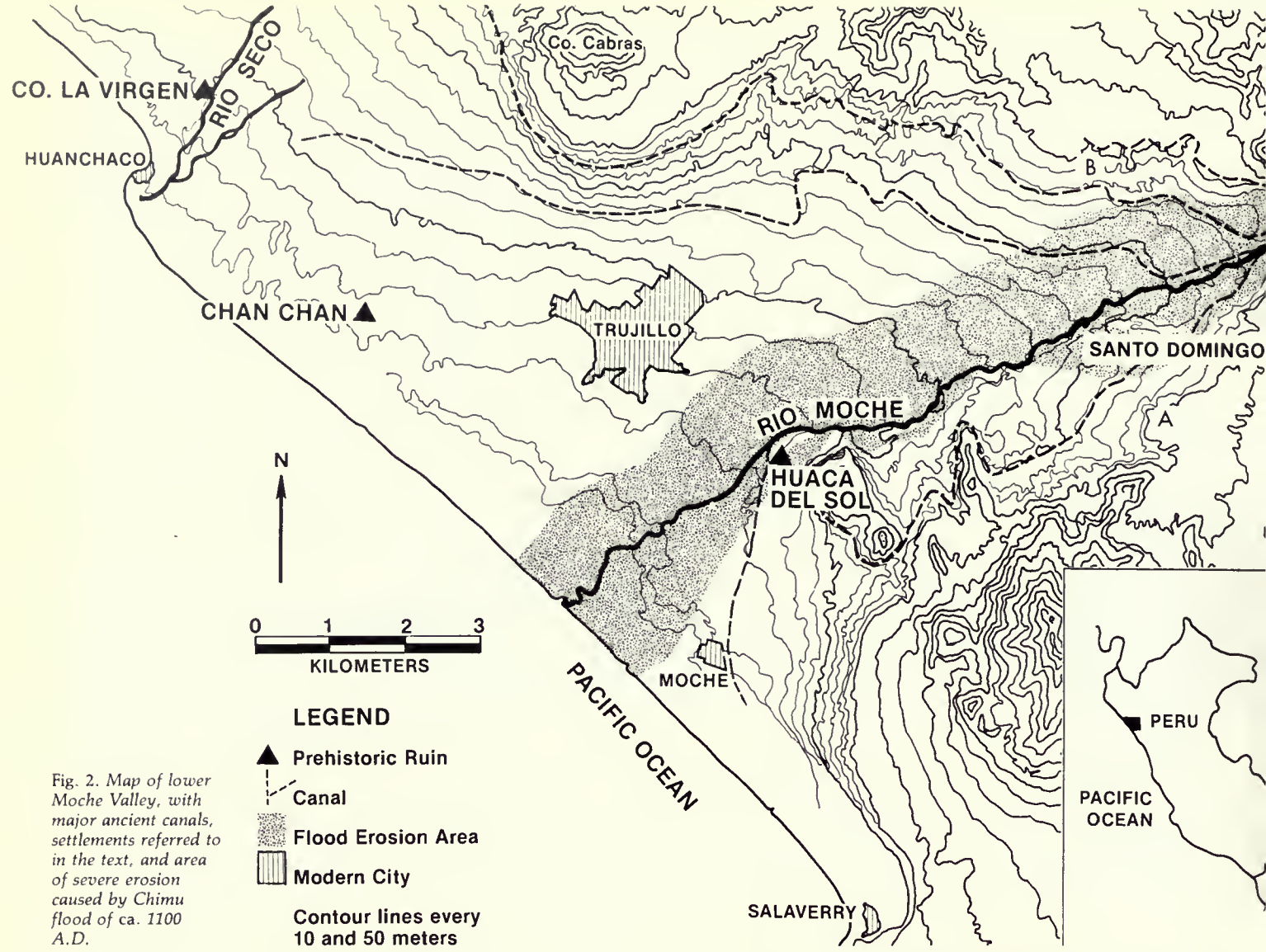



Fig. 2. *Map of lower Moche Valley, with major ancient canals, settlements referred to in the text, and area of severe erosion caused by Chimu flood of* ca. *1100 A.D.*

1957, 1965, 1969, and 1972. They can be categorized as "weak" or "strong," with the former having a statistical periodicity of about 6 years and the latter about 15 to 16.5 years. Weak occurrences have little effect on rainfall or river discharge in the Moche drainage. The strong niños of 1925, 1941, 1957, and 1972 all correlate with increased river discharge, but they have not always produced significant rainfall within the lower valley.

Niños occurred before the turn of the century, but these are not always well documented. Noteworthy rains took place in 1701, 1720, 1728, and 1747, as well as in 1891, which had floods second only in severity to those of 1925.

The great niño of 1925 was the most devastating since the coming of the Spaniards. In mid-January of that year warming waters were first noted near Peru's northern border at the port of Talara (Lat 5°45′S). Within 10 days the water temperature increase amounted to 6.6°C and kept rising. The warming waters progressed south, and by mid-March temperatures off the Moche Valley were as high as 28°C. Off Lima (Lat 12°S), January began with a normal sea surface temperature of 15°C, but within three months, highs of 26°C were reached before the temperatures settled to a nearly constant 22°C. Warmer than normal conditions were noted still further south, below the Paracas Peninsula (Lat 14°S), and the total coastline length of waters affected by the disturbance exceeded 1,200 km. A return to normal cool temperatures began in mid-April, but a second, less severe temperature rise occurred late in 1925, with warmer than usual waters persisting into 1930, when el Niño finally departed.

During the disturbance the trade winds diminished and then reversed themselves. Apparently there was a reversal of surface currents, and warm waters pushing south from Ecuador swept crocodiles and other tropical life into the sea coves of the northernmost desert. The effects of

**Measure Equivalents**

1 millimeter (mm): 0.04 inch

1 meter (m): 1.094 yards

1 kilometer (km): 0.62 mile

To convert Centigrade to Fahrenheit, multiply by 9/5 and add 32.

el niño upon indigenous marine life were catastrophic. High temperatures and cessation of upwelling currents cut off the supply of chemical nutrients and phytoplankton underlying the vast food chain that normally makes these waters the oceans' richest.

The death among various fish populations is difficult to calculate. However, it was dramatically evident one step up the food chain. The Humboldt Current supports what is probably the world's largest population of oceanic birds, whose droppings over the millennia accumulated in island deposits more than 40 m thick, forming one of the finest natural fertilizers known. Prior to the 1925 cataclysm the population of these guano birds was estimated at about 30 million, and judging from the impact of later niños, it plummeted to a quarter of this figure. Indeed, strong niños, such as that of 1925, litter the ocean floor with such massive numbers of dead organisms that the foul-smelling hydrogen sulfide produced by the ensuing decomposition is sufficient to blacken ships' hulls and the sides of houses along the shore. As testimony to nature's loss of life, the gruesome phenomenon is a harbinger of death appropriately known as *el pintor* (the painter)!

The warming of the sea was accompanied by rising air temperatures over land and by rains that resulted in abnormal precipitation at least as far south as the Paracas Peninsula. Threatening black clouds accompanied by thunder and lightning accumulated in front of the Moche Valley and then advanced inland early in March, unloading 226 mm of rain within three days. By the end of the month the city of Trujillo was awash under 395 mm of rainwater. There are no accurate records of what the cloudbursts unleashed in the surrounding foothills, but observers reported walls of water sweeping down normally dry quebradas. The Río Moche rose to its highest point in memory, spilling over vast tracts of farm land, destroying the irrigation system, and taking out the river bridge connecting Trujillo with the rest of the world (*Fig. 3*). At its height the flood lapped at the base of Huaca del Sol, the great archaeological monument of the Moche Phase (*Figs. 4,7*). To the north the normally dry wash of the Quebrada Río Seco carried flows as high as 300 cubic meters per second, inundating the fringes of the Huanchaco fishing village (*Fig.2*).

The immediate impact of the catastrophe was death and destruction; but the long term effects were famine and great suffering. With many kilometers of roads and railroads washed away, supplying outside aid on the massive scope required was difficult or impossible. Reestablishing the food supply from farming depended upon the time-consuming process of reconstructing the damaged canal networks. The fishing industry came to a standstill, and the guano fertilizer industry would take years to recover. All this transpired over half a century ago, when the landscape was a rural one. Today many people reside along the desert coast, Trujillo is a sprawling urban center, more than four million people reside in Lima, and the world economy is tied to the fertilizer and fishing industry. A repeat of the 1925 events would be truly disastrous.

Fig. 3. *Rains and floods of 1925 caused extensive flooding near Trujillo, carrying out this railroad bridge across the Río Moche. In normal times the stream could be forded by foot.*

## THE MOCHE VALLEY

The Río Moche drains into the Pacific Ocean at a point approximately 500 km north of the Peruvian capitol of Lima. Rainfall is extremely rare: at the fishing village of Huanchaco, on the north side of the Moche Valley, the total precipitation between 1943 and 1970 was only 46 mm, an astounding annual average of 1.7 mm. In contrast to that of many deserts, the relative humidity is high, averaging about 84 percent; but temperatures are mild, with a yearly average of about 19°C. Summer days are relatively clear, but during the winter there can be almost constant low-level clouds. At night and in the early morning the cloud layer produces a cool air inversion resulting in a misty drizzle, called *garua*, that can moisten

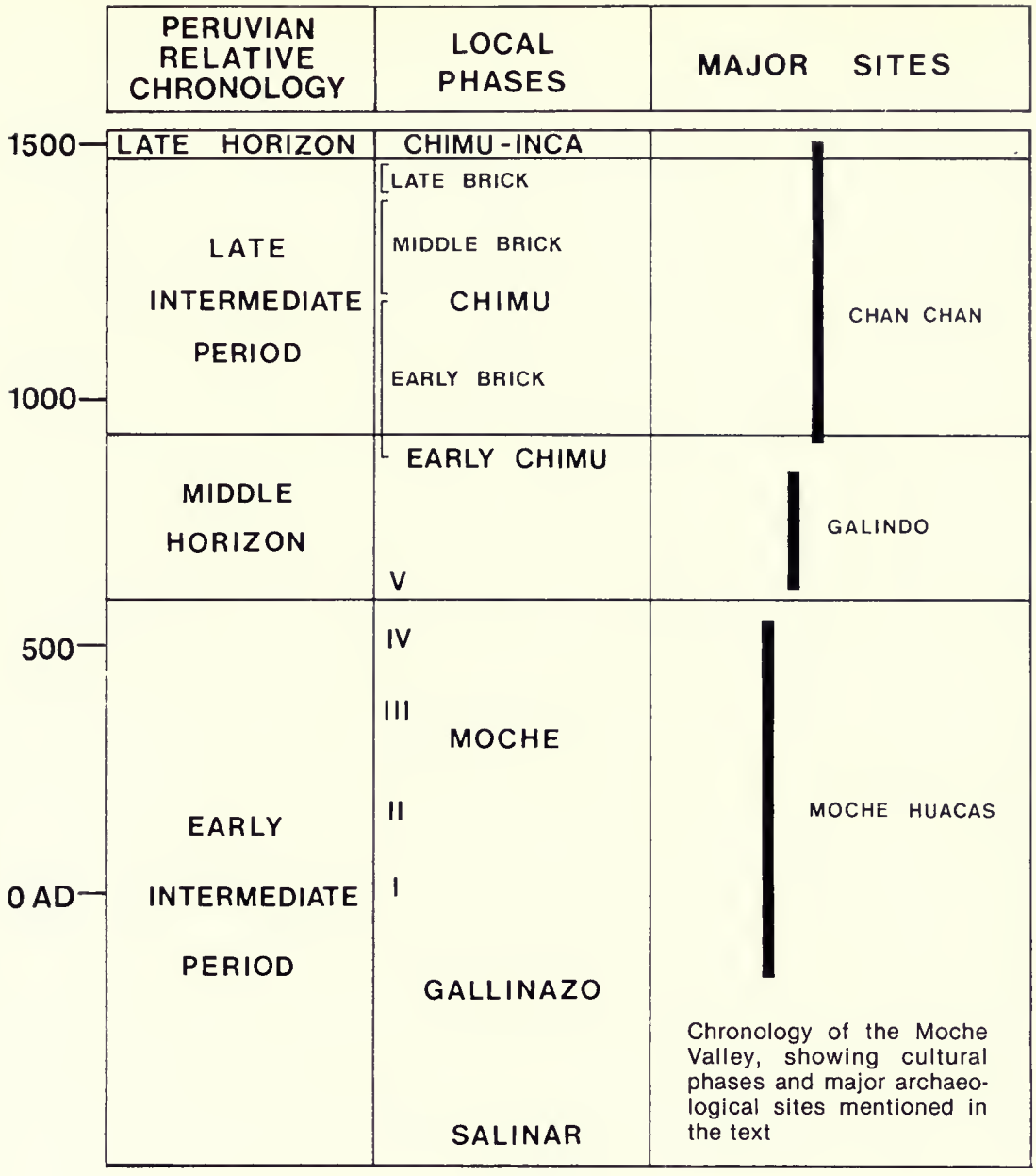
the ground surface, but seldom results in measurable precipitation. Thus, the normal climatic conditions are very favorable for human settlement wherever there is a source of potable water.

Emerging from steep mountain foothills, the lower Moche Valley widens as it crosses the less rugged terrain that comprises the coastal "plain." In this region, bedrock exposures consist of Jurassic and Cretaceous sedimentary and metamorphic rocks. Intrusive igneous rocks of Late Cretaceous and Early Tertiary age form most of the higher hills. Unconsolidated alluvial (stream sediment), marine, and aeolian (wind-blown) deposits underlie most of the coastal plain. Topographic features of the lower valley are mainly products of running water, wind erosion, and tectonic activity (shifting of the earth's surface).

The Andean Cordillera is a very young mountain belt. Although initial development began some 200 million years ago during the Jurassic Period, the mountains and coastline remain tectonically active. Historical accounts indicate that the Spanish colonial city of Trujillo, on the north side of the valley, was completely destroyed by an earthquake in 1619, and severely damaged by others in 1687, 1725, 1739, and most recently in 1970. There is geologic evidence for pre-Columbian tectonic activity, such as uplifted beachlines along the mouth of the valley which mark the former positions of shorelines. Some of these features can be archaeologically dated and correlated with the phases of prehistoric occupation summarized in Table 1. There is evidence of a major uplift during the Salinar or Gallinazo Phase, and subsequent periodic uplifts of smaller scale during the Chimu Phase. The total uplift since about 500 B.C. has been at least 6 to 8 m and must have affected the native population as well as their irrigation system.

A variety of active and stabilized sand dunes occur in the valley; and aeolian sand (that deposited by wind action) is found mixed with

Fig. 4. *View of Huaca del Sol (right background) and Huaca de la Luna (center foreground). A Moche cemetery about midway between the two huacas provides evidence that the plain between them had been inundated by flood waters. The present-day course of the Moche River is through lighter area near top of photo. (Courtesy American Museum of Natural History)*




Chronology of the Moche Valley, showing cultural phases and major archaeological sites mentioned in the text

TABLE I

Early Quaternery alluvial deposits, indicating a long history of aeolian activity. Blowing off the sea in a nearly constant direction, the wind moves sand inland in the form of both longitudinal dunes and transverse dune fields that originate from an old, uplifted Chimu beachline. As the wind moves sand across the coastal plain, small amounts are trapped in and around occasional plants, thereby forming small accumulations called coppice dunes. Because these little coppice dunes are easily washed away, their presence or absence in drainage channels are useful indicators of past flood activity.

Although the coast is extremely arid, most geomorphic features are products of running water. There are two types of fluvial features, those produced by the Río Moche and those produced by runoff of local origin. Dry washes (quebradas), quebrada deposits, alluvial fans, and deposits at the foot of mountain slopes (piedmont slopes) are geomorphic features produced by coastal rains and local runoff. In the foothills, quebradas are characterized by narrow valleys and steep gradients. In areas that are less steep, large sediment loads have been dropped, forming extensive alluvial fans (*Fig. 8*) and piedmont slopes. Most fan deposits were eroded subsequent to deposition and a succession of three erosional surfaces can be recognized, the oldest being of presumed Early or Mid-Pleistocene origin. On the coastal plain, quebradas tend to be wide and shallow. The largest dry wash is the Quebrada Río Seco (north of and parallel to the Río Moche), which drains about 300 square km. Like other coastal washes, it is braided, or anastomosing, drainage with multiple interwoven channels forming the flood plain. Because the drainage basin is small and the sporadic desert showers are intense, there is a high rainfall-runoff ratio in the form of short-term flash floods charged with sediment, which ranges from clay to boulders. Gravels and larger rocks are commonly deposited in the braided channels and on intervening bars, whereas sand and finer sediments are dropped along the margins

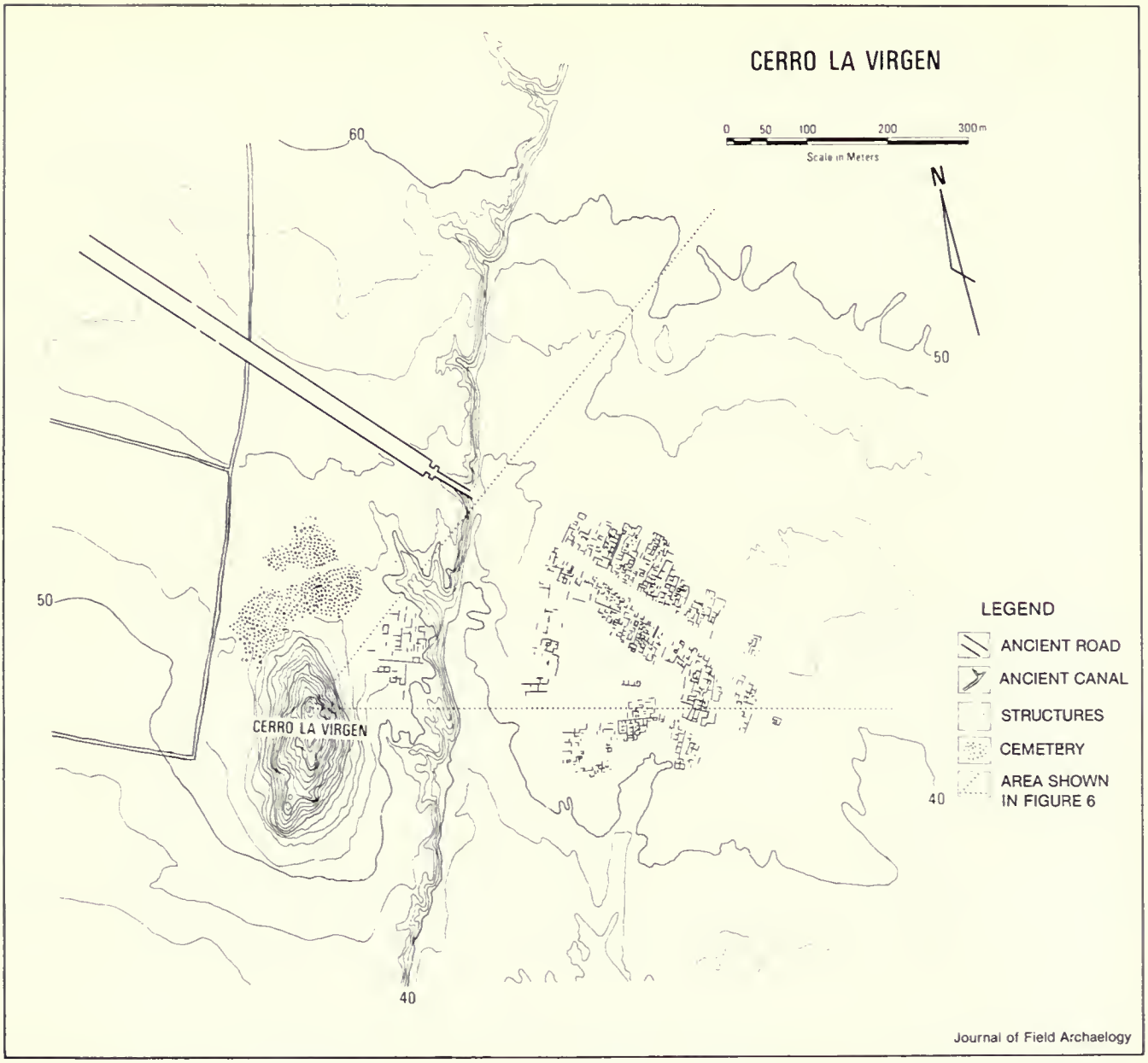



Fig. 5. *Map of Chimu village of Cerro la Virgen, showing area flooded by Chimu niño. The sector of photo view shown opposite (p. 11) is indicated by dotted lines radiating from Cerro la Virgen.*

of the flow and in slack waters with low velocity. The Río Seco carried some water in its upper basin during the 1972 rains; however, the last time a significant flow reached the Pacific was in 1925.

In direct contrast to the dry quebradas, the Río Moche is a permanent stream with a drainage basin covering approximately 2,708 square kilometers, 52 percent of which is located at elevations above 1,500 m. Rainfall varies from less than 2 mm at the river mouth to 1,400 mm per year at its highland headwaters. The river flow is markedly seasonal with 71 percent of the annual discharge between February and April, and only 1.8 percent between July and September. The average annual discharge is approximately 300 million cubic meters, but variations from one-sixth to twice this figure have occurred during the period 1930 to 1970, for which river flow records exist. The largest volume of water ever carried in the last hundred years was during the 1925 niño, when vast tracts of farm land were inundated. However, there are no precise records on the magnitude of this devastating flow. There were strong niño disturbances in 1941, 1957, and 1972 that correlated with larger than normal discharge. However, the largest river floods between 1930 and 1970 were products of excessive highland rains, not coastal disturbances.

Within the lower valley the main river channel is 50-150 m wide, and is incised to a depth of about 3.5 m below the adjacent floodplain, which is inundated only during unusually large floods. The river is located near the southern margin of the valley, and is actively eroding laterally, especially to the south. The valley is asymmetrical in cross section, with the north side sloping gradually down to the channel, whereas the southern river bank forms an escarpment 10 to

12 m high. Although agriculture has modified the landscape, at least two geologic terraces can be recognized along the north side of the valley. At the present time, the river is downcutting its course, a process that was well underway during the middle phase of the Chimu occupation. This downcutting is presumably a response to tectonic events, such as coastal uplift, and subsequent readjustments of the river gradients.

## The Prehistoric Occupation

Man first entered the Moche Valley as a hunter-gatherer some 12,000 years ago. With passing millennia he placed progressively greater reliance upon plant foods, and by 1,000 B.C. farming had come to support most of the population. Initially, plant tending must have gone on in the river flood plain where seasonal inundations moistened the soil. The desert could not be farmed until people built canals to divert river water onto the parched landscape, a process that required great effort and time.

Archaeologists divide Moche Valley prehistory into temporal phases, the more recent of which are named after local pottery styles (*Table 1*). During Salinar and Gallinazo times many people resided along the valley margins, which would have been habitable only if there were nearby canals, none of which exists today. The following Moche occupation is divided into five subphases on the basis of successive changes in fancy pottery found in graves. During the third and fourth subphase the valley assumed regional political importance. On the south side of the river the great platform mounds of Huaca del Sol and Huaca de la Luna were the principal monuments of a thriving capital city. On the north side of the valley, Moche people extended their canal network up to the edge of the Río Seco, well beyond the confines of modern farming. These are the

Fig. 6. *This photo of Virgen Village (A), taken shortly after the 1925 rains, provides valuable information on the size of the worst floods in the area in recorded history. The 1925 channel (B) is dwarfed by that of the Chimu flood of ca. 1100 A.D. (C). Small coppice sand dunes, visible here as "freckle-like" spots (D), make it possible to calculate the depth of the 1925 flood waters. (Courtesy Peabody Museum, Harvard University)*

Fig. 7. *Partially receded waters of 1925 flood, viewed soon after, has undercut base (A) of Huaca del Sol. Broad plain between Huaca del Sol and Huaca de la Luna has built up to about level of B. In contrast to 1925 flood, which reached to about 3 m above present river level, Chimu flood waters were some 10-15 m higher (C).*

earliest ancient canals surviving for scientific study. By the beginning of the fifth pottery subphase the capital at Huaca del Sol was abandoned and a new urban center was founded near the valley neck, only to be abandoned at the end of the Moche era.

At the time that Chimu pottery came into use, the local population began to cluster around the site of Chan Chan on the north side of the valley. With time the local rulers united the valley population and then began a series of foreign conquests. Eventually the city became the splendid capitol of the largest empire to contest the Inca, who finally subdued Chan Chan about 1465 A.D. The Chimu phase can be subdivided on the basis of its pottery and upon architectural grounds, based upon changes in the mud bricks used to build Chan Chan. During the early brick phase the rulers of Chan Chan launched a series of massive reclamation projects. On the north side of the valley the Moche canal system was extended completely across the Río Seco and onto the plains north of the quebrada, bringing far more land under cultivation that is farmed today. This project was a highly centralized, coordinated undertaking that integrated the canals with new field walls and road systems, and which planned towns for rural populations that had to be relocated. Indeed, the potentates of Chan Chan were concerned not simply with expanding agriculture, but with completely transforming the landscape.

With careful study we were able to cross-date this great transformation process to the early architectural subphase of the capitol. Yet, it became apparent that all the canals showed signs of massive erosion and had dropped from use. The irrigation system was then reconstructed and although it saw little significant use it also showed much less evidence of erosion. By the middle brick phase, Chan Chan had expanded into formerly farmed areas, great walls incompatable with farming were built across the Río Seco irrigation system, and much of the valley had reverted to desert. Something truly disastrous had happened, and to this day irrigation agriculture has never regained the territory it lost. We have choosen to call the ancient cataclysm the "Chimu flood."

Many niños struck the desert coast during the millennia of man's residency in the Moche Valley. Dealing with their specific impact and consequences requires the capability of recognizing a particular niño and consistently distinguishing it from all others. If this difficult task can be accomplished for two or more niños, then their relative magnitude and impact can be compared. This is an entirely new line of investigation that we came upon quite by accident in the course of studying ancient agriculture.

The most suitable archaeological remains for dealing with past niños are long linear structures—such as canals, roads, and walls —that cross a number of gullies and quebradas, To serve their intended purpose these structures must be intact along their total course. A canal cannot be washed out in one or two places and still irrigate fields at its terminus. Therefore, erosional destruction is something that takes place when a canal ceases to function. It may be the cause of canal abandonment or it may occur sometime after the structure ceased to be used for other reasons. These alternatives can generally be discerned in the more than 400 excavations we have opened in irrigation structures. Aeolian sand deposits are found in canals that fell into disuse prior to experiencing erosion. Alternately, operational canals destroyed by an erosional event are often clogged or buried by alluvial sediments. It is evident from our excavations that the early Chimu irrigation system was operational when it was washed out and destroyed. Because the course extended well beyond the Río Moche, we can determine that the destruction was due to runoff from local rainfall.

When the Chimu rebuilt the irrigation system, they often placed the reconstruction canals slightly higher, enabling them to parallel but bypass sections of the destroyed system. Therefore, many drainages are crossed by both an old and a new canal. The cases are particularly important because the parallel canals provide means of comparing erosional destruction. Having surveyed and mapped hundreds of kilometers of ancient waterways crossing all magnitudes of quebradas, we can say the erosional destruction of the original canal is significantly and measurably greater than that of the rebuilt course. Where a reconstruction phase canal stretches across a drainage it either remains intact to this day or, if it is washed out, the break is measurably smaller than the break in the original canal.

It might be tempting to say that the combined erosional effects of all niño-induced floods descending after reconstruction never equalled the destructive effects of the flood that took out the early Chimu system. However, this pushes the evidence a bit far, because the reconstructed canals are often stone lined and more massive, and

Fig. 8. *Early rains washed out many sections of a canal (A) near this Moche Valley ruin (foreground). A later canal (B) is not as extensively destroyed, indicating that the earlier rain was heavier than subsequent ones. Other linear features, such as the prehistoric roads (C,D), show a similar pattern. (Courtesy American Museum of Natural History)*

thus more erosion-resident than the original canals. We have considered the possibility that the relatively greater erosion of the earlier canals is a product of their greater age and often simpler construction. However, for extensive erosion to have occurred along the entire length of the early canal network, a long period of abandonment and normal weathering would have been required prior to the reconstruction phase. Our excavations have not indicated such a lapse in canal use.

Attention has also been given to the possibility that braided quebrada channels might have produced differential erosion of parallel canals. In braided drainages water normally shifts from one channel or set of channels to another, and one flash flood can flow in a different area with different velocities and greater lateral erosion than another flood. Therefore, in a channel crossed by an early washed-out canal and by a later, less eroded, canal the lack of destruction of the latter could have been due to natural shifts of later flood waters to alternative channels.

Figure 8 illustrates a wide drainage and an incised braided stream that are crossed by parallel canals, the earlier of which snakes along below its straighter reconstruction course. The earlier canal is consistently more eroded than its later counterpart. Because the canals cross all the channels of the drainage and because the reconstruction canal is well preserved, it is possible to check for potential shifts in water flow from one braided channel to another. No significant shifts are evident. In the case of the incised stream we have found no remnants of the earlier canal, and only faint tracery of the reconstruction course. Here there is simply insufficient preservation of the canals to control for every channel in the stream bottom. Both situations in figure 8 are common along the many kilometers of the ancient irrigation system. In quebradas with poorly preserved canal remnants evidence of the Chimu flood can be equivocal. However, for the many drainages where there is good archaeological preservation, significant channel shifting can be checked and evidence of the Chimu flood is unequivocal.

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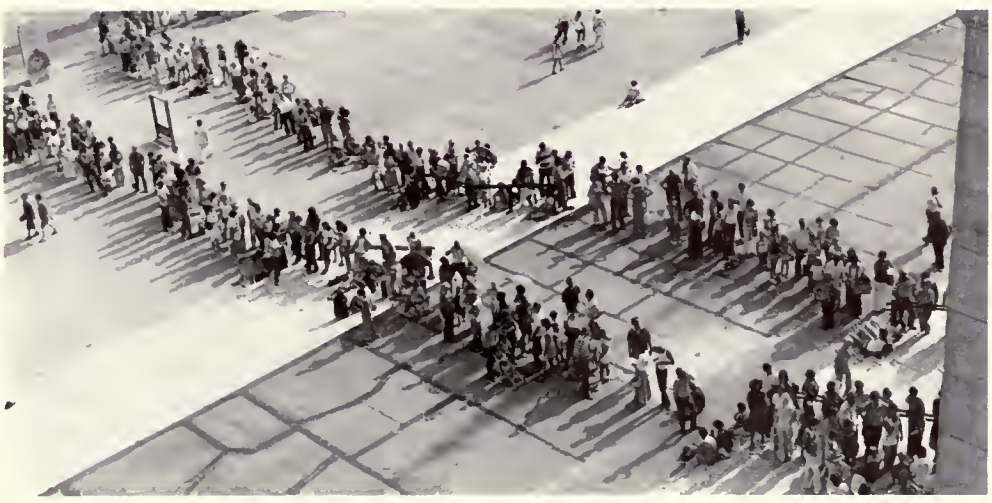
*The story of the Peru floods will be concluded in the September* Bulletin.

# Field Museum of Natural History 1977-1978



# In the Past Two Years...

Field Museum of Natural History

1977-1978

A BRIEF REPORT

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E. Leland Webber

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Field Museum has never before published a report like this. It's new and it's for you — our more than 45,000 members and supporters. By creating a brief report and including it in the *Bulletin*, we know that we will achieve one goal: cost reduction. We hope to achieve greater readership as well. We want you to know and understand what we are doing. A full report in our traditional format also has been produced in a limited edition. If you would like to receive a copy of the full report, call or write the Membership Department. We'll be happy to send one to you.

## IN THE PAST TWO YEARS . . .

Two of the largest undertakings in the history of Field Museum proceeded simultaneously in 1977. Even as record-setting crowds attending the "Treasures of Tutankhamun" exhibition surged through the Museum, our eight-year-long building renovation and improvement program continued apace. That we were able to bring this $26-million project to virtual completion during this active period is evidence of the co-operation of many segments of the Museum's community and is a tribute to the special strengths and resources of our institution.

To begin, the collective generosity of the Museum's friends — children, adults, corporations, and foundations — combined to raise a total of $12,623,925 for the Capital Campaign completed in 1974. This sum enabled the Museum to qualify for a matching $12.5 million from the Chicago Park District bonding authority. We thus owe thanks to our donors, the taxpayers of Chicago, and also to our Trustees and many volunteers from the Women's Board and the corporate community for their dedicated efforts on our behalf.

Next, architects, construction managers, contractors, Museum Trustees, and staff worked together to plan and execute this massive program. Many of the improvements have been detailed in earlier reports and still others are cited in this report. The Museum has been changed. It has improved. And we are proud of it.

Our new "front door" — a floor-to-ceiling window wall enclosing a spacious reception area in the north portico — was completed in time to greet the crowds queuing up for the enormously popular "Treasures of Tutankhamun" exhibition in mid-April, 1977. With the aid of grants from the National Endowment for the Humanities, Exxon Corporation, and the Robert Wood Johnson, Jr. Charitable Trust, the Metropolitan Museum of Art in co-operation with the Organization of Antiquities of the Arab Republic of Egypt arranged this loan exhibition. The United States tour of 55 objects from the tomb of the Egyptian pharaoh Tutankhamun included six American cities; Field Museum and the Oriental Institute of the University of Chicago were co-sponsors in Chicago. Admission to the exhibition was free; the regular Museum general admission fees remained in effect.

*Upper left:* Visitors lined up to view "Treasures of Tutankhamun." *Lower left:* Dr. Saleh A. Saleh, conservator of Cairo Museum, and Dr. Ahmed El-Sawy, Egyptian government official, examine statue of Selket in preparation for "Treasures of Tutankhamun" exhibition. *Right:* Workmen installing huge glass panels in north portico. (Dave Walsten photo)

# In the Past Two Years...

From April 15 through August 15, 1,348,000 people visited this spectacular exhibition. This is, to our knowledge, the greatest attendance for a temporary exhibition in the United States. According to the Chicago Tourism and Convention Bureau, the city's hotel and restaurant trade garnered a hefty $30-million boost from traffic related to the exhibition. It was estimated that about 300,000 out-of-town visitors were drawn to it. Day after day, long lines of Tut enthusiasts stretched down the Museum stairs and around the building. People slept on the stairs to be certain of gaining admission the following morning; others rested and chatted in lawn chairs brought from home.

For four months the media focused on the crowds attending the exhibition. Radio stations set up "hot lines" to provide up-to-the-minute information on waiting time; newspapers offered almost daily features on the event; television stations provided interviews with both visitors and staff. It was clearly a unique phenomenon in the Museum's history.

A second, major temporary exhibit attracted considerable public and critical attention during this two-year period. From February 15 through May 21, 1978, "Peru's Golden Treasures," the largest collection of Peruvian gold artifacts ever shown in the United States, was on display at the Museum. Like the Egyptian exhibition, this too was the result of a co-operative effort between funding agencies, museums, and government. "Peru's Golden Treasures" came to the United States under the auspices of The National Institute of Culture of the Peruvian government. It was organized by the American Museum of Natural History and was supported by a federal indemnity from the Federal Council on the Arts and Humanities, United States. Again, like "Treasures of Tutankhamun," no special admission fee was levied for this exhibition.

Field Museum's installation of this exhibition combined pieces from our collection with those from the Museo Oro del Peru to establish a context for understanding the five major periods in Peru's prehistory. A 75-page catalog with 32 color plates was published by Field Museum to complement the exhibition.

Although high attendance figures are important, the success of exhibitions must be measured in long-term gains as well. As a result of these and other outstanding exhibitions, many people were made aware of Field Museum for the first time; others returned to renew old ties. Impressively, at the close of 1978 the Museum's membership numbered 43,457 as compared to 26,125 at the close of 1976. We were gratified as new members who joined the Museum during the Tutankhamun exhibition indicated their approval and involvement with Field Museum by renewing membership in 1978.

We believe that our members and the Museum enjoy a mutally rewarding association. During 1977-1978, the Museum offered members a number of special opportunities, including exhibit previews, dinner lectures, environmental field trips, tours to Egypt and Peru, and adult evening study courses. Our members have repaid our efforts with enthusiasm, interest, and support beyond the annual membership fee.

*Upper left:* "Peru's Golden Treasures" catalog. *Upper right:* "Peru's Golden Treasures" exhibition in Hall 26. *Lower left:* Dr. Ahmed El-Sawy at ceremonial opening of Tut mask. *Lower right:* Ceremonial Chimu knife or *tumi* from "Peru's Golden Treasures." (Royal Ontario Museum photo)

PERU'S GOLDEN TREASURIES

# In the Past Two Years...

Members and non-members alike have enjoyed the many programs offered by the Public Programs division of the Department of Education. For example, the number of Ray A. Kroc Environmental Field Trips nearly doubled, from 47 in 1977 to 85 in 1978, with 4,442 adults and families participating in two years. These one-day trips were led by one or more specialists in the biology, geology, or ecology of such locales as the Indiana Dunes, Volo Bog, Moraine Hills State Park, Illinois Beach State Park, and the Ryerson Conservation Area. Courses for adults also increased and 73 courses were held in 1977-1978 with a total enrollment of 2,161.

A new dimension in programming began with the completed restoration of the Museum's Sundanese (West Javanese) gamelan. This gamelan, an ensemble of 24 musical instruments consisting of bronze and wood sounding parts supported by sculptured frames, appears to be about 130 years old and is one of the great ensembles of non-Western musical instruments in existence. Unplayed since 1893 at the World's Columbian Exposition, the gamelan was restored by a team of conservation volunteers who worked under the direction of Louis Pomerantz, art conservator; Ernst Heins, ethomusicologist and gamelan expert; and program director Sue Carter-DeVale. Grants from the National Endowment for the Arts and from the Walter E. Heller Foundation supported the long restoration project.

The gamelan was enjoyed in concert January 14, 1978. This concert was the beginning of a series of events based on ethnomusicology, including Javanese shadow plays, gamelan courses, a festival of music and dance, and children's music workshops.

Highlights of other public programs included the distinguished lecture series on Tutankhamun and another on "Peru's Golden Treasures"; the Anthropology Film Festival; the Noh, Inuk and the Sun dramas; lectures by Gerald Durrell and Richard Leakey; and the consistently popular Ayer lectures.

The Group Programs division of the Department of Education provides school-curriculum oriented tours, workshops, and loan materials free of charge to the Chicago metropolitan community and beyond. Although Chicago school enrollment is declining and this decline is reflected in Museum attendance by school groups, program services to schools increased 12 per cent in 1978. During this biennium 465,388 students and teachers in 9,570 groups came to Field Museum for programs and to use the exhibits as classroom supplements.

The Museum's Harris Extension provides materials for in-school use. Newly designed "Discovery Units" feature "Experience Boxes" which contain replicas or real artifacts and specimens for students to handle, examine, and study, as well as slide packets, teacher guides, and suggestions for classroom use. New topics focus on prehistoric life, pottery, birds, woodland Indians, Africa, Illinois prairies, and Chicago geology. Thirteen centers in the Chicago metropolitan area distribute "Discovery Units" in conjunction with other materials that go to 385 Chicago schools on a regular rotation schedule.

*Upper left:* Gamelan conservation volunteer Helen Urban. *Upper right:* Javanese dancers perform Topeng Babakan, a village mask dance, accompanied by Museum's gamelan. *Lower left:* Volunteer Judith Spicehandler at work on gamelan restoration project. (Louis Pomerantz photo) *Lower center:* Announcement of Ray A. Kroc Environmental Education Program. *Lower right:* Bi-monthly Calendar of Events.

Field
Trips

CALENDAR OF EVENTS
April-May, 1978
Field Museum of Natural History

# In the Past Two Years...

Both school groups and the general public have responded enthusiastically to the new participatory exhibit, "The Pawnee Earth Lodge," since it opened on October 15, 1977. A replica of a nineteenth-century Pawnee Indian dwelling, the lodge is 38 feet in diameter and 18 feet high at the central fire hole. A grant from the National Endowment for the Arts funded the construction of the lodge; the National Endowment for the Humanities funded research and design for this project.

Members of the Pawnee (Oklahoma) tribe served as consultants during the design and construction of the dwelling, made objects for it, and participated in taping four programs of seasonal Pawnee activities and ceremonies. Visitors — young and old alike — enjoy the authenticity of the lodge as staff and trained volunteers invite them to sit on buffalo skin robes, hear about Pawnee daily life and legends, and to examine artifacts representative of Pawnee activities. The lodge has hosted 39,144 visitors for special programs since it opened.

Volunteers are mentioned throughout this report and that is most appropriate. They work throughout the Museum on a regular basis and are a source of major support to staff and programs. Many services and research projects simply would not exist without capable volunteers to implement them.

At the close of 1978 the Museum was benefitting from the services of 280 volunteers. During 1977-1978 volunteers contributed 116,140 hours — the equivalent of 66 man years. In 1978, 13 individuals each gave more than 500 hours of volunteer service.

Volunteer work was performed in all four scientific departments, as well as in photography, education, exhibition, the library, membership, public relations, and publications. During the Tutankhamun exhibition, 350 trained volunteers gave a stunning total of 23,854 hours to that project alone. Many of those who were recruited for this exhibition stayed on to work in the scientific, exhibition, and education departments; 150 Tut volunteers returned to contribute 5,764 hours of assistance to "Peru's Golden Treasures." Further, 26 weekend volunteers share their specially developed tours, participatory activities, and workshops with Museum visitors of all ages. Based on permanent and temporary exhibits, 694 programs were presented to 21,659 weekend visitors in this two-year period. Most of the weekend volunteers are employed during the week. We believe that giving their weekend time to volunteer service is evidence of a special commitment.

The statistics are impressive and significant, but they don't give the whole picture. Volunteers are dedicated, but it is also the willingness to learn, the expertise and competency they bring to the Museum that is so much appreciated. The volunteer program is a fine example, not only of service, but of continuing education.

*Upper left:* Beverly Baker, education volunteer, demonstrates artifacts to children in Pawnee Earth Lodge. (Vicki Grigelaitis photo) *Right:* Sacred buffalo skull placed on altar mound in Pawnee Earth Lodge. *Lower left:* Virginia Beatty, volunteer in Department of Botany, prepares specimens for storage. (Vicki Grigelaitis photo) *Upper center:* Women's Board member and volunteer Mrs. Robert W. Carton with Mrs. Joseph W. Gibson, a member of Chicago Service Club, in Place for Wonder. *Lower center:* Young visitor examines specimen in "hands on" exhibit, the Place for Wonder.

# Our Collections: Our Treasures

## OUR COLLECTIONS: OUR TREASURES

Field Museum's scientific research programs encompass man and his total environment — past and present. Our collections of over 13.5 million specimens comprise a vast storehouse of data on man, plants, animals, and the earth. New specimens are constantly being added to this body of material through purchase, transfer, bequests, gifts, exchanges with other institutions, and staff field work.

The Museum's staff bases its research on these collections; however, that is not the extent of their use. Today institutions share exhibits, books, and computerized data; they have been sharing collection materials for many years. In 1977-1978 the scientific departments made loans of more than 125,000 specimens to scientists and students for research and to other museums for exhibition. Additionally, more than 2,500 researchers and university students visited the Museum to consult with our staff or to examine specimens.

Although the size of our collections is one of the major strengths of Field Museum and has done much to enhance our stature worldwide, we do not acquire new material simply for the sake of growth. Several years ago, the staff and Trustees collaborated to develop an accession policy which, among other things, sets conditions and priorities for the acquisition of new materials in terms of our traditional and current areas of interest. This policy has been described by one writer as ". . . more complete, more specific and more detailed than any we have seen . . . a polished, detailed and sophisticated document, very evidently compiled by a group of responsible persons after a lengthy and serious study of a set of very complex problems involving the museum and its relations with the world."

The acquisition of collections is one of the major responsibilities of a museum; the preservation of those collections for generations yet to come is another. As a means of fulfilling this trust and, simultaneously, providing for expansion space which will be required even for the limited collection increase that will result from the new accession policy, significant new storage areas and much-needed laboratory and office spaces were added in the departments of anthropology, botany, and zoology. This was yet another facet of the building renovation program.

Field Museum now has what we believe to be one of the finest anthropology study facilities in the museum world. Protected by a rate-of-rise heat indicator and sprinkler system, as well as a security system, the four-level, climatically controlled area houses about 300,000 specimens or 75 per cent of the Department of Anthropology's collections.

In conjunction with this central storage facility, an Anthropology Information Management System is being developed. Assisted by grants from the National Endowment for the Arts and an equipment gift from the Digital Equipment Corporation, this computerized system will assist in the management of the collection, including maintaining the inventory and recording the location of all objects within the facility.

*Upper left:* Chinese scientists visit Museum zoology laboratory. *Upper right:* A portion of the Division of Insects collection storage area. (Fleur Hales photo) *Lower left:* Video screen of computer terminal from Anthropology Information Management System. *Lower center:* Division of Invertebrates laboratory. *Lower right:* Entomologist John Kethley examines mounted insects. (Dave Walsten photo)

# Our Collections: Our Treasures

On the other side of the building, the new Ellen Thorne Smith Bird and Mammal Study Center provides a modern, secure, and functional facility for the housing of one of the world's great collections, as well as work and study space for staff, visiting scientists, and students. The center was made possible by a generous gift in honor of Mrs. Smith by her husband, Hermon Dunlap Smith.

Also in the Department of Zoology, the space of the Division of Insects was almost doubled and most offices and collections were relocated for greater efficiency as a result of the renovation. Further, the Division of Fishes was enlarged by one-third through the addition of new shelving. The Biological Research Resources Program of the National Science Foundation continued to provide support for several of the biological collections.

The Department of Botany, too, benefitted from the renovation program as it was both expanded and improved.

Entirely new quarters were provided the Division of Photography, aided by generous gifts from Mrs. David W. Stewart of Rochester, N. Y. in memory of her aunt, Hedwig H. Mueller. Our collection of more than 300,000 negatives dates back to the 1890's and includes many photos of historic significance.

Even as new space was being allocated, collection growth went on — as it must. Collections of breadth and high quality are essential to a great museum for both scholarly and exhibition purposes. Therefore, the selective building of our collections continues to be a priority of the Museum. Although all departmental collections grew during this biennium, a number of particularly noteworthy gifts have been made recently to the Department of Anthropology.

A collection of more than 100 Japanese lacquer objects, boxes, inro, and miniature shrines, collected with great care and discrimination by John Woodworth Leslie over a period of decades, was presented by Mr. Leslie. Many of these pieces of extraordinary quality will be exhibited in 1979.

Mr. and Mrs. Theodore VanZelst continued to make generous gifts, including a collection of American Indian trade silver and three fine groups of Alaskan, Pacific Northwest, and Canadian Arctic ethnological specimens.

Mr. and Mrs. John Mayo Mitchell presented a fine collection of American Indian trade silver that complements nicely both the Museum's original collection and the collection given by Mr. and Mrs. VanZelst.

Mrs. Helen L. Kellogg, who died in 1978, bequeathed a pair of fine T'ang pottery horses, as well as a generous sum of money, to the Museum.

*Upper left:* Curator Emeritus Emmet Blake studying specimens from bird collection. *Upper right: Inro* from collection of lacquerware given to Museum by Mr. John Woodworth Leslie. *Lower left:* Headdress of parrot and macaw feathers; a gift from Mr. and Mrs. Theodore W. VanZelst. *Lower right:* Chinese ceramic horses, T'ang dynasty; gifts of the Helen L. Kellogg Trust.

# Our Collections: Our Treasures

An outstanding collection of Japanese art, especially strong in ceramics and book illustrations, was given to the Museum by G. E. Boone in 1978. This collection will provide the nucleus for a systematic and comprehensive collection of Japanese arts and crafts.

All of these gifts came from private individuals. We believe that our evident concern and care for our vast collections and our efforts to maintain their high quality offer assurance to these collectors that their collections will be treated with equal respect.

Collections — as well as scientific knowledge — are also enlarged by field work. Some field trips take our scientific personnel only a few miles from the Museum, others require journeys of thousands of miles. In 1977-1978, 35 staff members from the scientific departments conducted field work. They went to several locations in the United States, to Mexico, Belize, Costa Rica, Panama, Venezuela, Ecuador, Bolivia, Peru, Argentina, Antarctica, England, Australia, New Zealand, the Philippines, Malaysia, Indonesia, India, Pakistan, Sri Lanka, Kenya, and Southern Sudan.

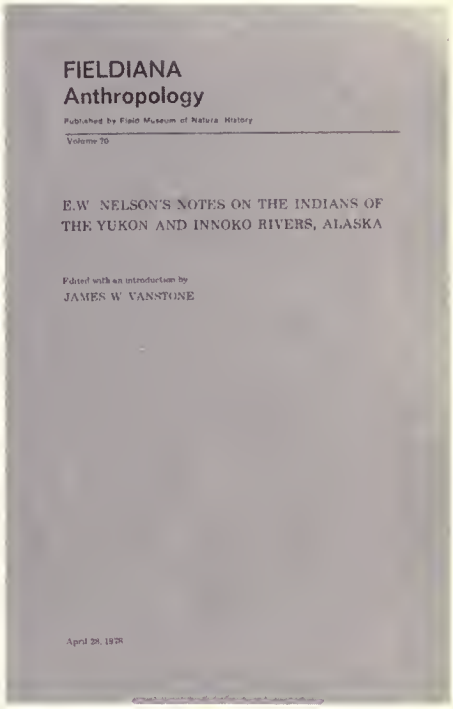
Finally, publication is the end result of most scientific research and field work. In 1977 two especially noteworthy books by Museum curators were published: *Manual of Neotropical Birds*, Volume 1 by Emmet R. Blake (704 pp.) and *Living New World Monkeys (Platyrrhini)* Volume 1 by Phillip Hershkovitz (1,137 pp.). Both volumes were published by the University of Chicago Press. These works, which have each received laudatory praise, are the culmination of years of meticulous preparation.

Forty-five titles, amounting to a total of 2,650 pages, were published in *Fieldiana*, the Museum's four scientific series, in 1977-1978. Including those appearing in *Fieldiana*, Museum staff published 153 scientific papers and books in this period.

Of course, we buy books as well as produce them. However, our Library is struggling to cope with a major budgetary problem caused by the sharp rise in the cost of books and periodicals due to inflation and the decline of the value of the dollar with respect to other currencies. The loss in the purchasing power of the dollar in many countries is a particularly thorny problem as much of our buying is done overseas. For these reasons, the cost of subscriptions to on-going periodicals accounts for a greater share of the budget every year.

We were able, nevertheless, to increase the number of books purchased in 1977-1978 by a significant 30 per cent. This was largely due to generous gifts made to the Museum for this purpose by Mr. and Mrs. Walter Cherry in memory of their son, Samuel M. (Cherry Library Fund); Mrs. Chester D. Tripp (Jane B. Tripp Library Fund); and Mr. and Mrs. Louis A. Wagner (Louis A. Wagner and Francis B. Wagner Library Fund).

*Upper left:* Researcher using auger along Wiscansao Canal as part of Programa Riego Antiguo (Ancient Irrigation Project) in Peru. (Robert Feldman photo) *Upper center:* Paleontologist Larry Marshall with emu while on field trip to Argentina. *Upper right:* One of 45 issues of *Fieldiana* published in 1977-1978. *Lower left:* Curators Emeritus Hershkovitz (left) and Blake at reception in honor of their books published by University of Chicago Press. *Lower right:* Plate depicting Shoveller Duck from John James Audubon's *The Birds of America,* a fine and rare work in the Library's collection.


FIELDIANA
Anthropology
Published by Field Museum of Natural History
Volume 70
E.W. NELSON'S NOTES ON THE INDIANS OF THE YUKON AND INNOKO RIVERS, ALASKA
Edited with an introduction by
JAMES W. VANSTONE
April 28, 1978

# Commitment to Distinction

## COMMITMENT TO DISTINCTION

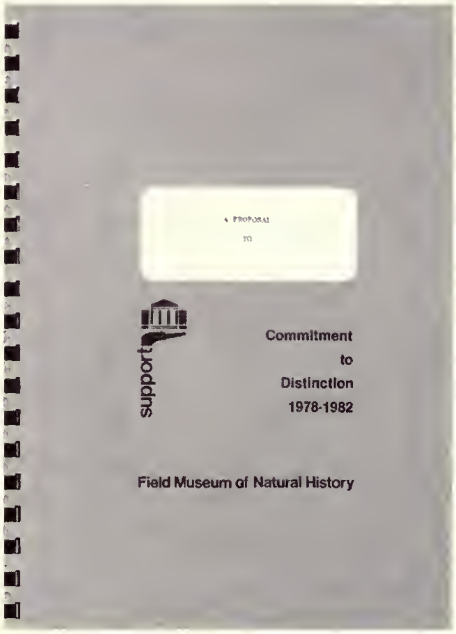
In 1975 we launched the Commitment to Distinction program to provide funds for operations and necessary capital improvements over a five-year period. We began well with gifts to this program totalling more than $1.7 million by the end of 1976 and our initial success has continued. Most significantly during this period, we received three-year challenge grant awards from the National Endowment for the Humanities and the National Endowment for the Arts. These grants total $1.5 million. This sum is the largest granted to any museum in the country by the two endowments' combined grants — an amount awarded to a very limited number of the nation's major museums. At the end of 1978, the Museum had successfully met the matching requirements for the first and second years of the grants. Commitment to Distinction funds have already been used to close the income gaps for 1976-1978. In 1978 this program was re-evaluated by the Board of Trustees — as it will be every two years — and was updated to 1982 with a goal of $13.3 million.

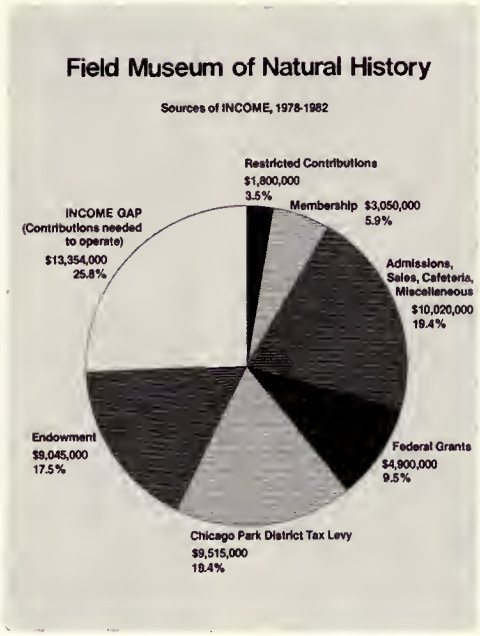
During 1977-1978 contributions to the program and for other Museum purposes totalled $2,905,868 from individuals and $2,034,448 from corporations and foundations for a total of $4,940,316. This remarkable sum came from the more than 4,500 individuals and 500 corporations and foundations who are currently contributing to the Museum over and above membership dues. It is these donors who, together with government and the users of the Museum, keep Field Museum the strong and dynamic institution that it is. Particularly generous donors during the biennium were:

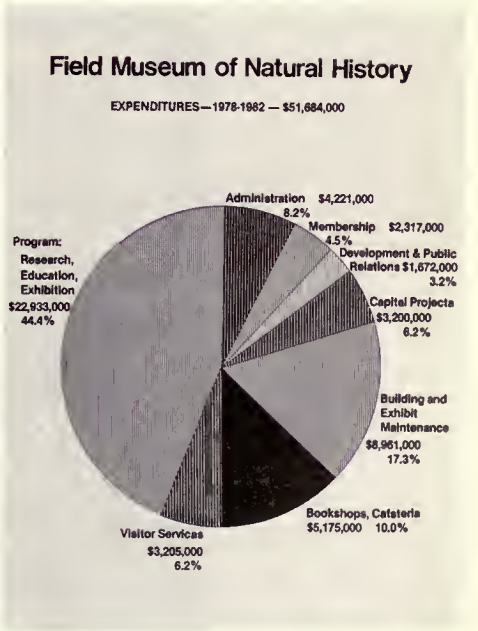
*Benefactors:* Helen L. Kellogg (bequest), Mr. and Mrs. Ray A. Kroc, Ellen Thorne Smith (bequest), Harold E. Stuart Trust, Amoco Foundation, Field Enterprises Charitable Corporation, The Joyce Foundation, Robert R. McCormick Charitable Trust, and the Woods Charitable Trust.

*Major Donors:* Mr. and Mrs. Walter L. Cherry, Mr. and Mrs. Eugene A. Davidson (Sterling Morton Charitable Trust), Mr. and Mrs. Joseph N. Field, Mr. and Mrs. John W. Leslie, Mr. and Mrs. William H. Mitchell, Mr. and Mrs. John S. Runnells, Commonwealth Edison Company, Continental Bank Foundation, The Chicago Community Trust, International Harvester, The Walter E. Heller Foundation, The Nalco Foundation, The Dr. Scholl Foundation, Sears, Roebuck & Company, The Frederick Henry Prince Trust, and Arthur Young & Company.

*Upper left:* Planning and Development Officer Thomas Sanders (right) reviews Commitment to Distinction progress with associate Clifford Buzard. (Fleur Hales photo) *Upper right:* Museum President-Director E.L. Webber (left) accepts the Xerox Corporation's contribution to the Commitment to Distinction from Marc T. Eisner. *Lower left:* Commitment to Distinction proposal. *Lower center and right:* Graphs depicting Museum income and expenditures for 1978-1982.


support
Commitment
to
Distinction
1978-1982
Field Museum of Natural History


Field Museum of Natural History
Sources of INCOME, 1978-1982
Restricted Contributions
$1,800,000
3.5%
Membership $3,050,000
5.9%
Admissions,
Sales, Cafeteria,
Miscellaneous
$10,020,000
19.4%
Federal Grants
$4,900,000
9.5%
Chicago Park District Tax Levy
$9,515,000
18.4%
Endowment
$9,045,000
17.5%
INCOME GAP
(Contributions needed
to operate)
$13,354,000
25.8%


Field Museum of Natural History
EXPENDITURES—1978-1982 — $51,684,000
Administration $4,221,000
8.2%
Membership $2,317,000
4.5%
Development & Public
Relations $1,672,000
3.2%
Capital Projects
$3,200,000
6.2%
Building and
Exhibit
Maintenance
$8,961,000
17.3%
Bookshops, Cafeteria
$5,175,000 10.0%
Visitor Services
$3,205,000
6.2%
Program:
Research,
Education,
Exhibition
$22,933,000
44.4%

# We Work Together

WE WORK TOGETHER

It is clear to all those close to Field Museum that a special synergism has developed here over the last decade. Five parts comprise the whole. We have already referred to our generous donors. Our staff is talented, hard-working, and dedicated to the institution. The Trustees carry their responsibility for the current stewardship and long-term strength of the Museum earnestly and energetically. The Women's Board is central to the Museum's well being and vigor. At the close of 1978 three Women's Board members were serving as Museum Trustees, eight were on Museum Board committees, and many more served as valued volunteers. The entire volunteer corps, mentioned earlier, completes this diverse yet united group.

Altogether, almost 1,000 men and women — staff, Trustees, Women's Board, and volunteers — combine talent, energy, and mutual confidence and respect with the financial support provided by donors to keep Field Museum strong in service to Chicago and the nation.

Of special note during 1977-1978 was the election of William G. Swartchild, Jr., retired, Swartchild & Company, as Chairman, succeeding Blaine J. Yarrington, executive vice president, Standard Oil Company (Indiana). Mrs. T. Stanton Armour, Robert O. Bass, vice chairman and chief operating officer, Borg-Warner Corporation, Mrs. Edward F. Swift, and Edward R. Telling, chairman, Sears, Roebuck & Company, were elected to the Board. Mrs. Swift was elected President of the Women's Board, succeeding Mrs. Joseph E. Rich. Donald Richards, a longtime Research Associate in the Department of Botany and a generous supporter of the Museum, and Remick McDowell, former chairman, Peoples Gas Co. and former President, Field Museum, were elected Life Trustees in 1977. Dr. Lorin I. Nevling, Jr. was appointed Assistant Director, Science and Education, succeeding Dr. Robert F. Inger, who returned to the Department of Zoology at his request after seven years in administrative posts.

We have made many gains during the past two years, but Field Museum has also suffered great loss. On March 16, 1977, Ellen Thorne Smith, one of Field Museum's warmest friends and most dedicated supporters, died. Mrs. Smith shared her knowledge, experience, and friendship with the Museum for 40 years. She formed the Women's Board in 1966, became the Museum's first woman Trustee in 1969, and maintained an active connection with the Division of Birds over a span of four decades. John G. Searle, a longtime Trustee and exceedingly generous donor, also died in 1977. In recognition of Mr. Searle's strong interest in our research program, the Museum's collection of preserved plants was named the John G. Searle Herbarium in 1972. Both Mrs. Smith and Mr. Searle were among the great builders of the Museum. We also keenly felt the losses of Life Trustees Hughston McBain, J. Roscoe Miller, and Louis Ware.

*Upper left:* William G. Swartchild, Jr., Chairman of the Board. (James Swartchild photo) *Upper right:* Women's Board Presidents, past and present (left to right): Mrs. Edward F. Swift (current President), Mrs. Joseph E. Rich (1976-1978), Mrs. Thomas E. Donnelley II (1974-1976), Mrs. B. Edward Bensinger (1972-1974), and Mrs. Edward Byron Smith (1970-1972). Mrs. Hermon Dunlap Smith (1966-1970), founding President, died in 1977. (James Swartchild photo) *Lower left:* John G. Searle. *Lower right:* Ellen Thorne Smith.

# Planning Ahead

PLANNING AHEAD

The successes of these two years have come about as a direct result of personal effort and long-range planning. We have presented enormously successful exhibits, offered a full spectrum of public programs, maintained a complexity of scientific research projects — all while executing one of the largest building renovations in United States museum history. Now we look ahead.

There is much to be done: work to be continued, new work to begin. For example, drawing on the richness of our collections and the creativity of our staff, we plan the renovation of our permanent exhibition halls — some have been substantially unchanged for decades. We must devote time and resources to the conservation of our irreplaceable anthropology collections. It is unthinkable that this world-resource would be allowed to succumb to the ravages of decay.

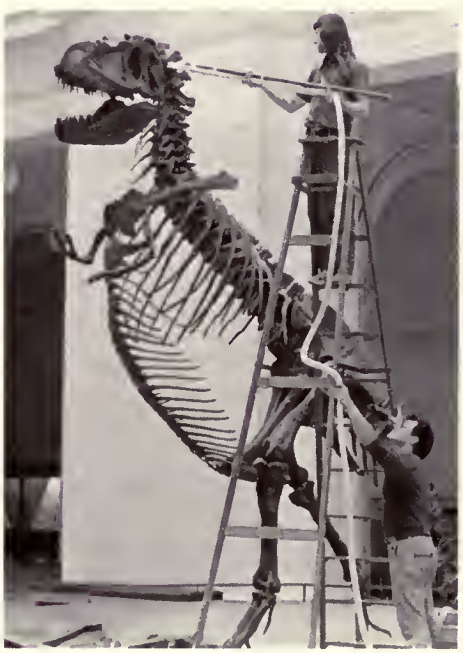
The prospects are exciting and stimulating — yet, we are seriously concerned. Ever-spiralling inflation faces Field Museum just as it does every family, company, and institution in the nation. If inflation continues at its present rate — with no increase, Field Museum will have to double its income in less than 10 years to keep pace. How can that be done? Finding the answer to that question is our single greatest challenge. New methods of support must be found and tested; new configurations of public and private collaboration must be found.

One important step was accomplished in this biennium when the Illinois General Assembly passed a bill, introduced by Representative Michael Madigan, appropriating $3,000,000 in support of Illinois museums on public lands. Governor Thompson, mindful of the legitimate responsibility of the state for partial support of museums that serve all of the people of Illinois, yet painfully aware, also, of the financial problems of the state, signed the bill into law at the level of $500,000, using his amendatory veto power. Field Museum received $95,000 from this appropriation. We wish to express appreciation to Representative Madigan, the General Assembly, and to Governor Thompson for this precedent-setting action which holds promise of a new partnership of local, state, and federal funding of major museums.

The newly formed federal Institute of Museum Services granted Field Museum $25,000, joining in a modest way the National Science Foundation, the National Endowment for the Arts, and the National Endowment for the Humanities, which for years have granted generous and pivotal federal fund support to Field Museum's programs.

It is these new and old programs of governmental support that, when melded with steadily increasing and generous contributions from individuals, corporations, and foundations, lend encouragement as we look ahead. But, after all, we return to the inescapable premise that inflation must be brought under control if Field Museum and, in fact, all private cultural, educational, and social service institutions are to survive in their historic forms.

*Upper left:* Governor Thompson and Museum President-Director Webber at signing of bill granting support to Illinois museums. (Riccardo Levi-Setti photo) *Upper right:* Museum painter Michael Gotto at work. *Lower left:* University of Heidelberg student Michael Müller-Karpe with 5,000-year-old Sumerian copper stag. (Fleur Hales photo) *Lower center:* Howard Bezin (left) and Salvador Castro, Jr. caring for *Gorgosaurus. Lower right:* Tools of zoological research trade.



# Financial Statement

FIELD MUSEUM OF NATURAL HISTORY
STATEMENT OF REVENUES AND EXPENDITURES — CURRENT FUNDS
Years ended December 31, 1978 and 1977

| | 1978 | | | | |
|---|---|---|---|---|---|
| | Operating fund | Commitment to Distinction fund | Restricted funds | Total | Percent of total |
| Source of revenue: | | | | | |
| Public funds — | | | | | |
| Chicago Park District tax collections | $1,503,705 | | | 1,503,705 | 17% |
| Government grants | 652,598 | 345,460 | 597,920 | 1,595,978 | 18 |
| Total public funds | 2,156,303 | 345,460 | 597,920 | 3,099,683 | 35 |
| Private funds — | | | | | |
| Investment revenue availed of for operations: | | | | | |
| Pooled security investments | 1,424,707 | | 225,235 | 1,649,942 | 18 |
| Securities of individual funds | 174,304 | | 114,309 | 288,613 | 3 |
| Total investment revenue | 1,599,011 | | 339,544 | 1,938,555 | 21 |
| Unrestricted contributions | 1,158,135 | | | 1,158,135 | 13 |
| Contributions designated by Board for future years | | | | | |
| Memberships | 671,172 | | | 671,172 | 7 |
| Private restricted funds availed of for operations | | | 85,510 | 85,510 | 1 |
| Total contributed revenue | 1,829,307 | | 85,510 | 1,914,817 | 21 |
| Earned: | | | | | |
| Admissions | 601,694 | | | 601,694 | 7 |
| Museum shops and cafeteria | 1,185,265 | | | 1,185,265 | 13 |
| Visitors' services and other | 317,184 | | | 317,184 | 3 |
| Total earned revenues | 2,104,143 | | | 2,104,143 | 23 |
| Total private funds | 5,532,461 | | 425,054 | 5,957,515 | 65 |
| Total revenue | 7,688,764 | 345,460 | 1,022,974 | 9,057,198 | 100 |
| Operating expenditures: | | | | | |
| Scientific | 1,335,687 | | 458,849 | 1,794,536 | 20 |
| Education and exhibition | 762,372 | | 374,535 | 1,136,907 | 13 |
| Publication and photography | 459,961 | | 25,761 | 485,722 | 6 |
| Library | 196,882 | | 14,332 | 211,214 | 2 |
| Building operations and security | 2,405,745 | | 479 | 2,406,224 | 27 |
| Administration and development | 1,558,874 | | 149,018 | 1,707,892 | 19 |
| Museum shops and cafeteria | 1,112,755 | | | 1,112,755 | 13 |
| Total operating expenditures | 7,832,276 | | 1,022,974 | 8,855,250 | 100 |
| Revenues in excess of (less than) expenditures before cumulative effect of a change in accounting principle for membership revenue | ( 143,512) | 345,460 | | 201,948 | |
| Cumulative effect on prior years (to December 31, 1976) of changing the method of accounting for membership revenue | | | | | |
| Revenues in excess of (less than) expenditures | $( 143,512) | 345,460 | | 201,948 | |

| 1977 | | | | |
|---|---|---|---|---|
| Operating fund | Commitment to Distinction fund | Restricted funds | Total | Percent of total |
| $1,514,760 | | | 1,514,760 | 11% |
| 327,917 | 375,000 | 592,793 | 1,295,710 | 10 |
| 1,842,677 | 375,000 | 592,793 | 2,810,470 | 21 |
| 1,246,783 | | 212,648 | 1,459,431 | 11 |
| 54,569 | | 111,166 | 165,735 | 1 |
| 1,301,352 | | 323,814 | 1,625,166 | 12 |
| 948,598 | | | 948,598 | 7 |
| | 187,500 | | 187,500 | 1 |
| 674,239 | | | 674,239 | 5 |
| 1,622,837 | 187,500 | | 1,810,337 | 13 |
| 1,596,647 | | | 1,596,647 | 12 |
| 5,446,353 | | | 5,446,353 | 40 |
| 188,279 | | | 188,279 | 2 |
| 7,231,279 | | | 7,231,279 | 54 |
| 10,155,468 | 187,500 | 323,814 | 10,666,782 | 79 |
| 11,998,145 | 562,500 | 916,607 | 13,477,252 | 100 |
| 1,280,492 | | 445,869 | 1,726,361 | 14 |
| 860,961 | | 408,823 | 1,269,784 | 10 |
| 363,934 | | 5,549 | 369,483 | 3 |
| 181,453 | | 12,991 | 194,444 | 1 |
| 2,613,232 | | ( 6,317) | 2,606,915 | 21 |
| 1,558,956 | | 49,692 | 1,608,648 | 13 |
| 4,854,143 | | | 4,854,143 | 38 |
| 11,713,171 | | 916,607 | 12,629,778 | 100 |
| 284,974 | 562,500 | | 847,474 | |
| ( 101,596) | | | ( 101,596) | |
| $ 183,378 | 562,500 | | 745,878 | |

# A Brief Report 1977-1978

Field Museum of Natural History
Roosevelt Rd. at Lake Shore Dr.
Chicago, IL 60605
312-922-9410

# Field Museum Tours

### Peru, Oct. 27-Nov. 15

A 20-day tour will visit the ruins of Machu Picchu, Chan Chan, Pachacamac, Purgatario, and others. The Plains of Nazca (viewed from low-flying aircraft), the Guano Islands, and the Pisac Indian Fair will also be visited. The group, limited to 20, will be led by Dr. Michael Moseley, associate curator of middle and South American archaeology and ethnology, and by Robert Feldman, assistant in archaeology. A tour escort will also accompany the group.

The tour cost—$2,998 (which includes a $500 donation to Field Museum)—is based upon double occupancy and includes round trip air fare between Chicago and Peru and local flights in Peru. Delta Airlines will be used between Miami and Chicago, connecting with Aeroperu. Deluxe accommodations will be used throughout. The package includes all meals, including inflight meals; all sightseeing; all admissions to events and sites; all baggage handling; all necessary transfers; all applicable taxes and tips; all applicable visa fees. Advance deposit: $250.00 per person.

### China, Nov. 5-25

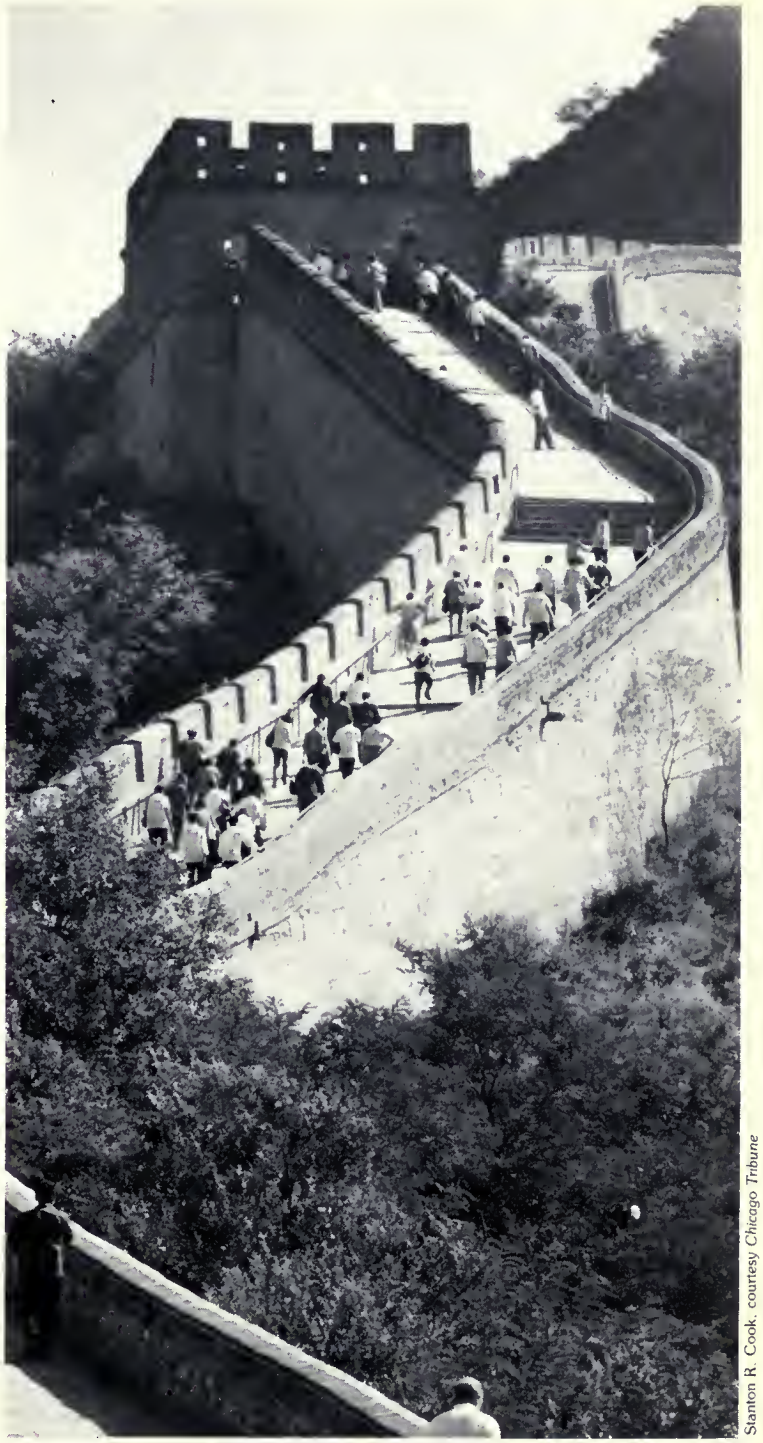
Peking's Forbidden City, the Summer Palace of the Dowager Empress, the bustling activity of Canton, the ancient pagodas of Kunming. These are just a sampling of the sights that lie in store for the 23 persons (Field Museum members and their families) who visit China on Field Museum's exclusive tour this November.

In addition to fourteen days in China, three days and two nights will be spent in London. The tour escort will be Mrs. Katharine Lee, a Field Museum volunteer in the Department of Anthropology who is fluent in five Chinese dialects. Additional guides in China will be provided by the China International Travel Service. The tour cost—$4,400 (which includes a $500 donation to Field Museum)—is based upon double occupancy and includes round trip air fare from Chicago to China. Advance deposit required: $500.00 per person.

### Antarctica, Jan. 6-30, 1980

Until recently, only explorers were able to view antarctica's wondrous beauty. There is no destination more remote, more unspoiled by the encroachments of civilization. Our itinerary includes the Falkland Islands, a visit to the Patagonian coast, the South Georgia Islands, the South Orkney Islands, and of course, antarctica. Dr. Edward Olsen, curator of mineralogy, will be tour lecturer.

The cruise vessel will be the 3,200-ton tourist ship *M.S. World Discoverer*, registered in Hong Kong, which will take us from Punta Arenas, Argentina, onwards. Built in 1974, the one-class vessel has all outside cabins with private lavatories and showers. The ship's staff includes a fully qualified physician. The tour leaves Chicago Jan. 6, 1980 and returns Jan. 30. Prices per person: C deck twin: $3,230; C deck single: $4,870; B deck twin: $3,570; B deck single: $5,390; A deck, twin: $3,930. Air fare, in addition, is $1,225 (round trip between Chicago and Punta Arenas, Argentina). Included in the tour price is a tax-deductible donation of $500.00 to Field Museum. Deposit required at time of registration: $1,000.00 per person.



Stanton R. Cook, courtesy *Chicago Tribune*

*The Great Wall of China*

For additional information and reservations for all tours, call or write Michael J. Flynn, Field Museum Tours, Roosevelt Rd. at Lake Shore Dr., Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.

# *JUNGLE ISLANDS*

## The "Illyria" in the South Seas

An account of the Crane Pacific Expedition of Field Museum, 1928-29. Abridged from *Jungle Islands*, by Sidney Nichols Shurcliff, G.P. Putnam's Sons, New York (1930). Reproduced here, as abridged, by permission of the author.

"Illyria has sailed for New York."

Thus ran the cable which we received on September 14, 1928, from the shipyards at Lussinpiccolo, Italy, where Cornelius Crane's brigantine yacht *Illyria* had been under construction for over a year. The fact that she was at last in commission seemed incredible. For six successive months the launching had been postponed. During that length of time the members of the projected Crane South Sea Scientific Expedition had led a life composed of alternate periods of frantic preparation and idle impatience . . . .

However, nothing discouraged Cornelius.* From the time I had known him as a school-boy, he had been determined some day to go through the South Seas, even if he had to swim. Fortunately Mr. Crane, Senior, had provided a

Above: *painting of the brigantine* Illyria, *Richard T. Crane's graduation gift to his son, Cornelius.*

**Cornelius Crane (1905-62). He was the son of Richard T. Crane, Jr. (1873-1931), a Field Museum trustee 1908-12 and 1921-31. Cornelius was also the grandson of Harlow N. Higinbotham, who had been president of the World's Columbian Exposition and of Field Museum (1899-1909).*

better method of transportation. The yacht *Illyria* was built as a gift to Cornelius . . . .

The *Illyria's* length overall was to be 147′ 6″; her height of foremast 116′, mainmast 128′; her gross tonnage 356. She would carry 10,000 square feet of sail and auxiliary power would be supplied by a 300 H. P. Diesel engine . . . .

. . . At first Cornelius had intended to take a group of friends on purely a yachting cruise. But as the *Illyria* was designed with ample accommodations, and as her owner was notably fond of hunting and fishing, it was decided that various experts in zoology, natural history and the like should be included in the party.

The trip therefore developed into a mixture of pleasure jaunt and scientific expedition. The latter phase fell logically under the wing of Field Museum of Chicago, as Cornelius is a native of that city.

The scientists of the expedition were: Karl P. Schmidt, herpetologist and director of scientific work, Walter A. Weber, artist and ornithologist, Frank C. Wonder, taxidermist, all of Field Museum; Dr. William L. Moss, of the Harvard Medical School, physician and anthropologist; Dr. Albert W. Herre, of Stanford University, ichthyologist.

Cornelius' fellow travellers were three Harvard men; Murry N. Fairbank, Charles R. Peavy and myself. I was semi-seriously appointed motion-picture photographer.

We had boasted that ours was to be the most completely equipped scientific expedition ever to sail the Pacific. We had laid our plans to bring an aeroplane with folding wings, two motorcycles and a side car, twelve trunks of medicines, several cases of dynamite, three motion picture cameras, 50,000 feet of motion picture film, two diving outfits, a moving picture projector, 25 rifles and shotguns with ammunition, complete apparatus for the capture, preservation and mounting of specimens—and a dog mascot. All very fine, but where to put them?

Much to the disappointment of Murry Fairbank, we first had to give up the aeroplane. Then we gave away the dog. We lashed the motorcycles and side car on the quarter deck in spite of dire warnings from the captain . . . .

At ten o'clock on the sixteenth [of November, 1928] we all gathered at the dock, with out friends and relations who came to see us off . . . . There was no sign of Murry Fairbank. At eleven forty-five the newspaper photographers posed us all for group photographs. At twelve o'clock the newsreel photographers who were there to film our departure gave it up as a bad job and went away. Then Murry Fairbank drifted in. He had read in the paper that we were to sail and had come down to find out if it were true.

At twelve-fifteen we did sail—not far, you understand, just to the mouth of the harbor where we spent the whole afternoon adjusting the compasses—but still we sailed. [Without Cornelius Crane, however. Taken ill at the last minute, he planned to join the others in Bermuda, after recovering.]

*Cornelius Crane aboard the* Illyria, *while she lay in Boston harbor before the expedition.*

Five days later [we sailed] into the beautiful harbor of Hamilton, Bermuda. We had spent those five days to good advantage in accustoming ourselves to the sea, the ship and each other . . . .

At Hamilton we found Cornelius, now well, and his father, waiting at the pier to take us to dinner . . . . We . . . came to several conclusions—that the motorcycles would have to be sent home—that the owner's launch, too delicately

built for use among coral reefs, should be left in Bermuda . . . .

Murry and I pleaded that one motorcycle should be retained, even if we had to put it in our stateroom.

"All right," said Cornelius laughing, "if you can get it in your stateroom you can keep it—otherwise it goes home."

So the next day Murry and I . . . took the motorcycle apart. We put the frame and wheels under his bunk and the motor into our trunk. Then ushering in Cornelius, we asked him if the room was in good enough order to suit him.

"Why, yes," he said, "but what is that curious smell of rubber?"

"Oh just the motorcycle tires under Murry's bed," we answered. He let us keep it . . . .

We had been in high spirits during our stay in Bermuda, but our mood changed as soon as we left protected waters, because the *Illyria* began to roll badly and everyone but Frank Wonder became seasick . . . .

Supper turned out to be a hilarious meal. Just as we sat down to the table the yacht gave a tremendous lurch and all the books fell out of the bookcase with a dull roar and cascaded in an avalanche over the floor. The two electric lamps on the table tipped into the soup and several dishes fell onto the floor, . . .

[Several days later] we reached Port au Prince, Haiti.

On the afternoon of our first day [there] we went to see some live snakes at . . . the new Ecole d'Agriculture. With surprising unconcern Schmidty reached into the cage and pulled out the largest one. The snake, an ugly green reptile with

*Launching of the* Illyria *at Lussinpiccolo, Italy, in September, 1928.*

*Sidney Shi[illegible] the expedition [illegible] ficial photographer, focuses on Field Museum herpetologist Karl Schmidt and iguana.*

white spots, twisted about and quickly bit our herpetologist twice on the wrist. Schmidty's calm was undistrubed. With a pleasant smile he returned the offender to the cage and remarked, "Yes, I *thought* that was a biting snake."

[That evening] we all listened with interest to [an account] of Dr. [William] Beebe's recent visit to Haiti and of his descent in a diving helmet to a depth of nearly twelve fathoms. We knew that we should be attempting similar feats before long.

. . . We arose early the next morning . . . to start on our trip of 230 miles overland to San Domingo City . . . .

Our hotel [in San Domingo] was said to be the best in the city but we discovered on the first evening that the food was either too highly seasoned or had attained too great an age to be edible. So we had to fall back on bread and boiled eggs. While waiting for the eggs to boil we noticed several mice who playfully scurried about the dining room floor and later our attention was attracted to some small bats which swooped about amongst the diners narrowly missing their heads.

In the bedrooms the fauna was even more varied than in the dining room. Although each bed was provided with an elaborate mosquito net, no provision had been made against those insects politely known as "beetles." Murry discovered several under his pillow and I found an army of them in my closet. The advance guard entered my suitcase. For several days I had to shake cockroaches out of my clothes before putting them on.

*After Haiti, the* Illyria's *next stop was Panama.*

. . . One of the animal boxes which had escaped a wetting on [Gatun Lake] contained about two dozen basilisks, a type of lizard about eighteen inches in length which is remarkable for its ability to run on the surface of smooth water. Schmidty had been at great pains to secure this collection in the hope of making a moving picture of their marathons . . . we took the basilisks down to the water and let one go.

Running along the float with surprising speed, the creature took a mighty jump into the water, but then instead of skimming along on the surface he dove below and at once disappeared. A second one did the same thing, first biting Schmidty severely on the end of the forefinger.

Since the remaining lizards seemed to be much weakened by their captivity we decided to release them all at once, in the hope that at least one would stay on the surface. We did so with the movie camera in full operation but not a single basilisk complied with our desires. This was all the more maddening in view of the fact that the lizards remained in the cove for several days and amused themselves each morning by scampering about on the water as we had wanted them to. However, the instant we approached they dove out of sight . . . .

[That night] Schmidty and Dunn [an old friend of K. Schmidt's] bundled up in heavy boots and shooting jackets. They . . . stumbled away into the dark, slimy maze of twisted vines, gnarled roots and buttressed tree trunks which make a tropical forest almost impenetrable at night. Hardly had the flicker of their lights disappeared in the gloom than a tropical rainstorm began to beat

*Murry Fairbank poses with Mabel, the sea lion whose pleasure was lounging in an armchair and listening to the victrola.*

down on us so fiercely that we half expected to see them return at once, but for over two hours there was no sign of them.

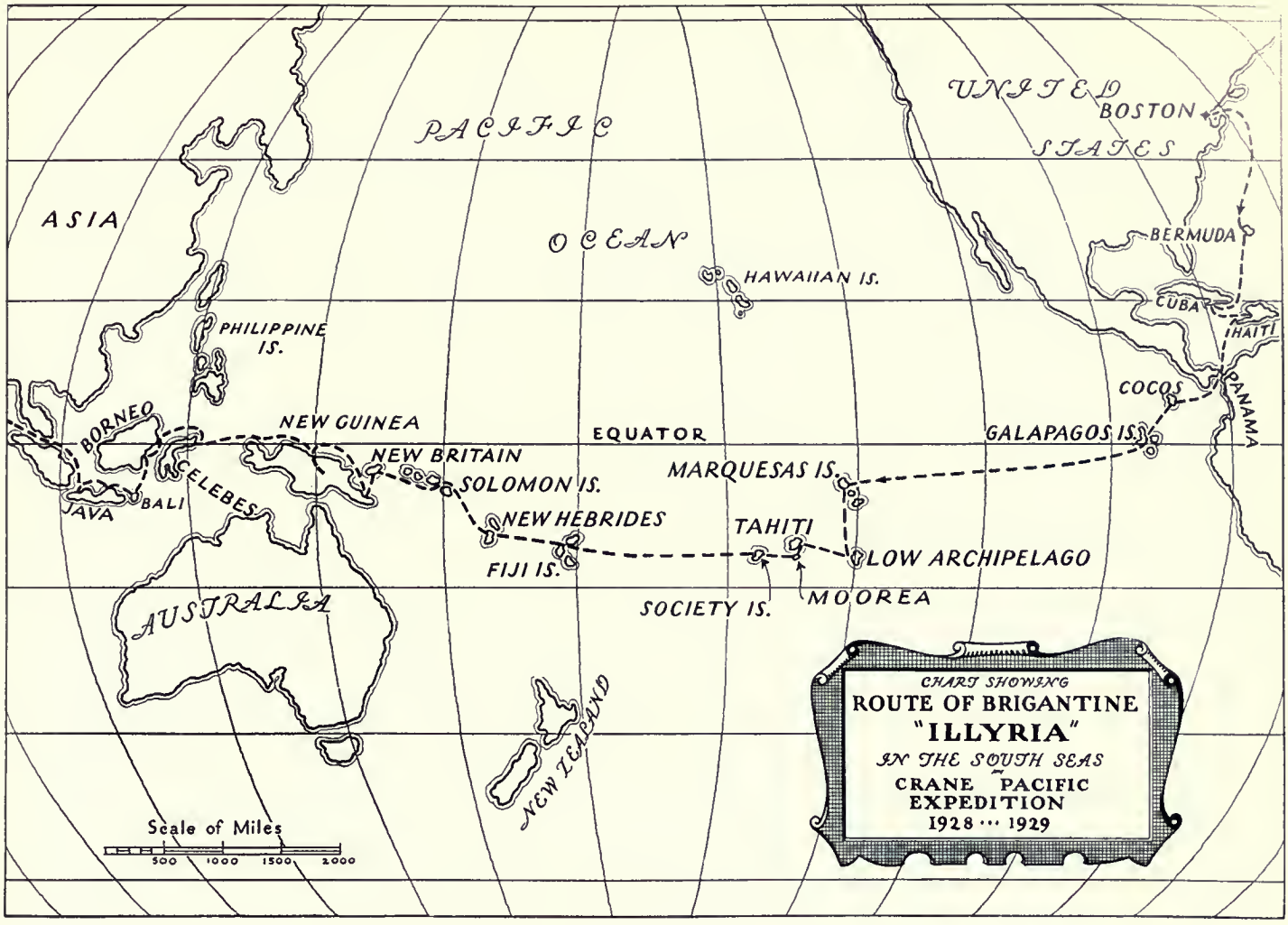
Finally toward midnight, they stumbled, all bedraggled and wet, into the camp, looking like a couple of fugitives from justice . . . . From their little collecting bags they first dragged an alligator about four feet long, which Schmidty had shot just after he had unwittingly stepped on a much larger one. Then out came a live turtle which tried desperately to bite everyone within reach. The next exhibit was an enormous tarantula, alive, four inches in diameter, from whose deadly fangs we all shrank until he was popped into a cage. The greatest find of the evening had been reserved for the last. Dunn, proudly reaching into his bag brought out a most amazing frog, about three inches long. Its triangular body and limbs were a luminous shiny dark green above and very bright orange below; while its enormous round eyes shone like jewels. Schmidty jealously admitted that it was an unknown and new species. Dunn explained that as this frog nestles against some green leaf he covers up all his orange colored parts, and is almost invisible. But if he is disturbed he takes an immense leap, flashing all his orange underparts at the observer who, seeing nothing but that color, hardly thinks of looking for a green frog where the orange one alights. Here is a case where the brightest of contrasts is the best possible camouflage . . . .

After lunch we brought out our prize specimen, a full grown anteater. He had evidently been considerably irked by his captivity for when Schmidty hauled him out by the tip of his long tail he quickly reversed himself, climbed up that appendage and made a pass with heavy claws at his captor.

After this we treated Mr. Anteater with more circumspection. We wired him by the hind leg to a tree and left him to cool down. Whenever we approached he reared onto his hind legs and tail and extended his muscular forearms in the position favored by boxers. In this defensive attitude, darting his long round tongue in and out, grunting, puffing and blinking his beady eyes he was one of the drollest animals I have ever seen. Later we brought him a termite nest, overflowing with light brown insects and stuck it under his long nose. The sight or smell of the termites made his mouth water copiously but he obstinately refused to eat. It was only after two hours of patient waiting beside the movie camera that I was able to film him in the act of darting out his sticky tongue to a length of five or six inches and quickly sucking it in again, with several unlucky white ants attached. So quickly did he manipulate his tongue that it was only a blur to my eye. Consequently his small prey had not the slightest chance of getting away. He finished his meal speedily and curling up into a hairy ball with his forepaws crossed over his head he went off to sleep, . . .

It was the end of my stay [at Barro Colorado Island in Gatun Lake]. Packing the equipment and some two thousand feet of exposed film I descended to the flimsy outboard boat. It ferried me safely to Frijoles where the afternoon train picked me up and bore me with great speed to Panama. I arrived at a late hour, hot and tired, but at the Hotel I found that Cornelius was counting on me for dinner, . . . after which we were to go to the opera. I climbed into evening clothes and a boiled shirt and was rushed to the Club where we descended on the dinner party in the middle of the second course. From there we made a mad dash to the theatre at the other end of the city and I who had been for a week in khaki pants on a tropical island floundering about in mosquito-infested swamps, found myself dazedly sitting between two pretty girls in evening gowns listening to an amateur version of La Boheme . . . .

There followed a week of the utmost




confusion. Our motion pictures had to be developed, printed and spliced for a test showing. The last letters for three months had to be written. Clothes, ammunition and other important articles had to be bought. The many animal and bird specimens . . . had to be prepared and shipped. And last but not least, everything on board the *Illyria* had to be taken out and aired to prevent moulding . . . .

. . . on the 29th of December we found ourselves ready to continue westward [toward Cocos Island]. On the third day out the first excitement occurred. We were sailing along under a light breeze when of a sudden the sailor on the masthead shouted "Submarine to starboard off the stern quarter!"

We reached for our glasses and observed on the horizon a dark spot, round of outline, except for a small projection on the top. The Captain rejected the submarine theory and declared it to be an overturned lifeboat with a man sitting on it. With much flapping of canvas and bracing of yards we headed into the wind and put about in its direction . . . . I loaded up all my cameras in expectation of great events.

Closer approach proved that not one of us had guessed right. The floating object was a dead whale, . . . now distended by the gases of decay to an enormous size. Its flank floated fully five feet out of the water and one fin stuck up almost straight into the air. Around the carcass the water was literally alive with enormous sharks and other carnivorous fish . . . .

*After a brief stay at Cocos Island, the* Illyria *continued southwestward, toward the Galapagos.*

. . . The weather is cool, although we are about to cross the equator. Schmidty says that the cold Humboldt current which flows from the Antarctic regions northward along the coast of South America to the Galapagos is the reason for the low temperature. The Galapagos are right on the equator and yet only semi-tropical in climate.

I am ashamed to say that Murry and I overslept this morning until we were wakened by the anchor chain rattling down in Tagus cove [on South Seymour Island, in the Galapagos]. The others had to wait for us before going ashore.

No vegetation or animal life of any kind is visible from our anchorage—no beaches—no queer animals—nothing but steep volcanic cliffs and reddish brown hills and mountains. Across the strait the rounded dome of Narborough, which sweeps with one majestic curve from sea to clouds, is also gray and barren. Yet the landscape is on such a grand scale, so fundamental in line and texture, that instead of being monotonous it is strangely stirring.

About nine-thirty we all got into the launch and, towing a small boat, went about half a mile to the head of the cove . . . As we were clambering from the boat onto the steep shore Chuck gave a shout of alarm.

"Look out!" he yelled, "a big piece of lava is rolling down on us."

We looked up the little valley and saw at the top a big sea lion, which did indeed resemble a piece of lava at that distance. He snorted loudly as he saw us and, turning around, flounced back up the gully. We pursued and soon surrounded him and three other sea-lions who apparently had been sunning themselves on the lava. They retreated to a position under an overhanging ledge, but did not seem very much afraid and allowed us to approach within two or three feet without trying to escape. Their gray brown color is almost the same as that of the lava. We took several pictures and then stampeded them down the gully into the water for the movie camera, but as usual I ran out of film in the middle of the scene.

*The "submarine" that turned out to be a dead whale.*

Further up the ravine a large bright-colored grasshopper flew into Murry's face and nearly put out his eye. But he risked himself again about five minutes later by picking up a dangerous stinging scorpion, which he thought was a spider, to give to Schmidty.

In spite of our jeers Schmidty had brought along a big black umbrella which he had carried defiantly under his arm though there was not the remotest chance of rain. We soon found his reason for bringing it. He placed it upside down under a bush and then wacked the bush with a stick until a lot of spiders and beetles fell in. These he picked up with tweezers and put one by one into a jar of alcohol, solemnly watching their dying convulsions . . . .

[Later] we came upon at least 200 iguanas sitting on the rocks and sunning themselves. These strange antediluvian creatures fit into the extraordinary landscape as if created solely for it. They have the same splotched black and gray coloration as the lava on which they bask and their shape is much like that of some of the ripples left in the lava when it cooled. They are well adapted to life along the shore, for their long powerful toes are equipped with recurved claws which allow them to maintain such a strong grip on the lava that even a heavy wave cannot pry them loose.

They vary in length from three to four feet when full grown and their outer skin consists of hard scales which are dull red and green after the skin has been freshly changed but lose their color after a short time. The crest of spines down the middle of the back and the sharp conical scales on the upper surface of the short head contribute to their queer appearance . . . .

We found them to be very tame indeed, perhaps because they have no natural enemies on land . . . . When we did not disturb them too violently they contented themselves with nodding their heads at us very vigorously and blowing little bubbles from between their sharp teeth and goat-like lips . . . .

After I finished writing last night Dr. Herre tried a fishing experiment. He lowered to the

surface of the water a bright light which attracted a great number of mackerel. They were so numerous that the water appeared to be alive and squirming. We managed to catch forty or fifty with harpoons, nets, baited hooks and we even got one on a bare hook. Then a shark came near and all the fish disappeared as if by magic.

[The next day] the rest of the party unrolled a tremendous seine about 250 feet long and hauled it around in a semi-circle near the beach. It took them about half an hour of good hard work to get the seine around the semi-circle and to haul it up onto the shore, but all they caught were three small puffers which, no matter how much they inflated themselves, could not seem a very large catch to Dr. Herre.

Afterward I walked southward along the beach . . . until suddenly I saw what looked like a dead sea-lion, being battered about in the surf. However, when I approached it came to life and swam away.

A little further along I came upon another large male rolling in the surf in the same way. He would allow each inrushing wave to carry him up the beach in a swirl of foam and then when the water receded he would roll down into the next oncoming breaker like a sack of cement. This sea-lion must have been asleep, for his eyes were closed and although I approached within ten feet to take pictures he took no notice of me for over a minute. Then he seemed to awake with a sudden start, snorted loudly, glared at me and dashed away.

[Later I caught a young female sea-lion] by one hind flipper. It seemed pretty tame, so we christened it Mabel and brought it back to the *Illyria* with us . . . .

We have just been trying some experiments with Mabel. She likes to listen to the victrola and to sit in a plush armchair. We put her into the sink in the laboratory and turned on the water. When she was only partially submerged she tried to dive, but of course couldn't, so she became very angry and splashed water all over us.

As I write we can see lights flashing six miles away on Narborough, where we left the scientists. The radio operator says the flashes are not in code, but they well might be, for we have found that the campers left all their blankets and cooking utensils on board the *Illyria*—true absent-minded scientists!

*On another of the islands, the group met a Norwegian settler, a Mr. Horneman, who with his wife was trying to start a banana plantation. The couple had an eight-month-old child.*

[Mrs. Horneman] had managed to convey to me with fragments of English words the idea that her baby was very pale as a result of living in such a rainy district. Wishing to be polite I said "Nevertheless, he looks like a very intelligent baby."

Of course she could not understand so I tapped my forhead, pointed at the baby and said, "Bright! very bright!"

Mrs. Horneman gave a great gasp and turned frightfully pale. She directed a startled glance at the baby and said "Not blight! Not blight! Oh, No!"

Plainly her greatest fear was that the baby might be taken sick so far from any doctor. I tried to calm her by saying—"Oh, no! I meant brains! The baby has brains!"

Unfortunately she thought brains was another disease and it took the combined efforts of both Schmidty and Dr. Herre, each speaking eight different languages at once, to reassure her.

We presented Horneman with a whole carton of cigarettes and went outside to eat our lunch. He was too short on food to invite us to eat with him but he and his wife started to make some coffee for us.

Cornelius hauled out a bottle of cognac which had been brought along and was about to pour it into our tin army cups when there came a great cry of "Hola!" and Horneman dashed out with some wine glasses which he must have been treasuring for just some such occasion.

We all drank to the health of his wife and child and then presented him with the rest of the bottle, still half full. He was delighted and again ran into the house and brought out two stools and a board, out of which he made a table. He covered the table with a nearly clean, white linen tablecloth with blue embroidered trimmings.

Then he produced a tray on which were a lot of demitasse coffee cups, white with gold rims

*Albert W. Herre, Stanford University ichthyologist, measures shark.*

Fleur Hales

*Alan Resetar, present custodian of the reptile and amphibian collection, examines shell of extinct Charles Island tortoise, collected by Karl P. Schmidt more than half a century ago.*

and a sugar bowl with some home-refined sugar. His wife brought out the kettle of coffee and he poured us each a cup with the gravest of ceremony and politeness.

"Well!" said I to myself, "here we are at the very end of the world, where no one ever comes and where the only inhabitants are barefoot and dressed in ragged overalls, and have beards down to their waists. One would hardly expect the formality of a blue and white table-cloth and demitasse in gold cups!"

It struck all of us as being so delightful that we gave the Hornemans all the rest of our supplies.

I went to sleep as soon as we got back to the boat but Schmidty woke me up about five-thirty. He had "found" . . . a big cave with extinct turtle shells in it, and wanted me to go down into it with him to take flashlight photographs.

. . . we discovered several dozen shells of the extinct Charles Island tortoise, three in perfect condition. Schmidty is delighted to secure these shells for the museum, for this type of tortoise has been extinct for more than a hundred years. . . .

*The* Illyria *headed westward for the Marquesas, some 3,000 miles further on.*

The Marquesas were sighted early in the morning of February fifth . . . . All nine of us climbed into the skiff and attempted to make a landing but a native policeman dressed in little save a red straw hat motioned us away . . . . Then a white man in white clothes and a pith helmet appeared and told us in French that we could not land until we had been O.K'd by the doctor. We had to wait nearly two hours for this medical man who finally arrived in an outrigger canoe and gave his official consent.

We learned from the governor that disease has been prevalent in the Marquesas since the advent of the white man and nearly all of the true natives have died off. At present there are only 300 inhabitants on this large and beautiful island and many of them came from Tahiti and other outside places. There are only 3,000 inhabitants in all the Marquesas, and the population is still decreasing.

Most of the natives we did see were either sick or very old and feeble—not just what one might expect after reading some of the popular South Sea novels. There was something very depressing and decayed about the whole atmosphere.

Nor is the island a good collecting ground for scientists. There are no mammals or interesting reptiles, and what few birds can be found are well known. There are some ruins of moderate anthropological value but the governor told us that the most interesting remains of the former high civilization could be reached only by a ten hour ride on horse-back . . . .

Since there was very little of scientific interest at Hiva Oa, we sailed away the following day, and reached the Island of Nuka-Hiva the next morning . . . . The scientists, in the meantime, had had a far more exciting time. Dr. Herre had persuaded some of the natives at Taiohae bay to help him cast his big seine. The very first haul resulted in the capture of no less than 10,000 fish. Most . . . were a type of mackerel . . . and the weight was so great that it took nearly half the population of the village to pull the seine ashore. The beach was alive with gleaming silvery shapes, and when the net was emptied the natives ran to their houses for receptacles to put them in. No such catch had ever been made in the bay before and everyone rejoiced at this addition to the food supply. When we returned in the evening we saw long lines of fish drying on ropes stretched between the trees . . . .

*After the Marquesas, the* Illyria *sailed nearly due south for the Tuamotu, or Low, Archipelago. From there the expedition proceeded to Tahiti.*

. . . The scientists had been impatient at the length of our stay in Tahiti. They had made some casts and paintings of fish, but in general the collecting had not been good. Nature has been more lavish with geographical and vegetable

forms than with animals and insects in all the Polynesian islands. Each morning the scientists had gone hopefully ashore with guns and collecting bags, but in the evening they returned in dejection seldom with more than a few small birds and two or three bottles of insects. The specimens they did get were not unusual. Schmidty felt we were wasting time and should push on.

It is a long way from Tahiti to Fiji—over two thousand miles—and it took us twelve days to make the trip. We allowed ourselves only one stop—a very short one at Borabora and there we found anchored in the harbor the small sailing yacht *Chance*. On board were three bronzed young athletes from Yale, Dodd, Brown and Marshall by name. They had started from New London on a South Sea cruise nearly nine months before and had sailed all this way with the help of only one navigator and a cook. There had been two more Yale boys on board at the start, who, by the time we met the party had gone on side expeditions of their own. The three remaining boys came aboard the *Illyria* for supper.

Their point of view was quite different from ours. They sailed on no fixed schedule and lingered wherever it pleased them. Sometimes they would go ashore and live with the natives for a week or more. A lazy life appealed to them, but they assured us that they were learning a lot more about the South Seas than were we, with all our scientists and sailors. Who knows? Perhaps they were.

At Ovalau, about seventy miles from Suva, we anchored the *Illyria* in a large bay . . .

*Richard T. Crane, father of Cornelius, was a Field Museum trustee 1908-12, 1921-31.*

*Taxidermist Frank C. Wonder (left) and artist Walter A. Weber work on specimens in the laboratory aboard the* Illyria.

just between twilight and dusk. Schmidty suddenly pointed toward the mastheads. Looking up, we saw a host of dim gray flying forms softly silhouetted against the last faint pink of the sunset.

"Flying-foxes!" exulted Schmidty. "Fruit bats! A whole horde of them. I had been hoping we might see some. They are not rare in this part of the world, but they are different on every island —and we must get some for the museum." He told us that these creatures hang upside down on trees during the daytime and sometimes there will be so many on one tree that the branches are broken. At night they make a flight all together, just at dusk, from the roost to their feeding grounds.

"Look!" he cried. "There are thousands of them—big ones!"

They were flying across the bay to the cocoanut plantations where they would spend the night destroying and eating the unripe fruits . . . .

Schmidty decided that they would probably return just before sunrise, following the same line of flight.

. . . The ones we got were remarkable creatures. They were nearly five feet from wing tip to wing tip . . . . They had long snouts, sharp teeth and pointed ears, like foxes, and their bodies were covered with reddish brown fur. Having tongues and palates, they could scream and make barking noises. "Flying-fox" is a good name, for these mammals really look like small foxes equipped with wings.

We spent two more days at Ovalau, during which Dr. Herre collected a number of unusual fish and the scientists collected several more species of land birds and insects. Except for bats, no mammals of any sort were found. Then we sailed back to Suva to pick up Dr. Moss, who had stayed behind to make anthropological measurements. We had also to put aboard supplies in preparation for our trip to the New Hebrides.

. . . it was a relief to reach Vila, the largest port in the New Hebrides, on March 27th. The town itself was a great disappointment to those of us who had not prepared by reading about it in the *Encyclopaedia Britannica*. I had a mental picture, gleaned from popular books of a tiny place set on the edge of the jungle and environed by cannibal villages. Instead I saw a full-sized town composed of docks, streets and red-roofed houses with automobiles parked in front of them. There was not a single cannibal to be seen and even friendly natives were absent for they have been displaced by the Indonese laborers imported by the French. Dignified Englishmen strolled about, canes in hand or sipped cooling drinks on spacious verandahs. Nothing could have been further from the popular idea of a cannibal isle than Vila.

We soon abandoned our hope of finding romance on shore. However, on the floor of the harbor we met with better success. Descending in about six fathoms of water with our diving helmet we found the visibility to be very good and spent the whole afternoon taking turns at exploring the corals on the bottom or photographing them with our underwater camera. . . .

There is infinite variety in the corals. Some rise in thick coarse branches from the sandy bottom like ghostly bushes which, decapitated and bleached, have long been dead. Some formations are rounded and soft like giant foot-stools while others are angular, brittle and cruelly pointed. Still other fronds are intricate and delicate in their branchings and infinitely varied in their pastel colorings. The ocean floor might be compared to a flower garden in full bloom though the latter would suffer by the comparison since, seen through the green-blue medium of sea water, the colors of the undersea world although bright, are never glaring nor unharmonious. Both color and form are more complex, more erotically luxuriant and more vaguely mysterious than in the world above.

The gentle winds which sway the flowers of the upper world have also their marine counterparts for the ceaseless surging of the ocean swell imparts a sweeping motion to the seaweed and other flexible growths on the bottom and to the minute animal and vegetable particles suspended in the water. The motion is slow, dignified and almost monotonously regular. Everything sways at the same instant and moves the same distance. Yet there is something awe-inspiring in this incessant surge of the depths—this pulse of the sea. It began when the earth was young and it will continue just as slowly, just as irresistibly until the sea is no more.

A man with a diving helmet could spend days, even weeks on a fifty foot square of coral reef and yet find something new and interesting every hour. Nevertheless most of the white inhabitants of the tropics are satisfied to peer through a water-glass once in a great while and would not dream of diving even in places where there are no sharks. They excuse themselves with talk of poisonous corals, of deadly jellyfish, of spined sea-urchins and of molluscs which might snap shut on their ankles. As a matter of fact these dangers are mostly mere superstitions and with a little care diving is as safe as playing golf.

Acting on advice from the officials at Vila we sailed that same evening for Bushman's Bay on Malekula Island to seek information regarding bird-collecting and native life from Mr. Adam, the District Officer. Arriving at the Bay the next morning we were again discouraged by the civilized aspect of the landscape. Several neat white houses and sheds stood under orderly rows of cocoanut palms and a Ford truck loaded with cocoanuts chugged in the foreground. . . .

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*The adventure of the* Illyria *will be concluded in the September* Bulletin.

# July, August, and September at Field Museum

*(July 15 through September 15)*

### New Exhibit

**"Treasures of Cyprus."** Opened June 14. These 150 objects reflect nearly 8,000 years of Cypriot art and culture. Situated at the crossroads of three continents—Europe, Asia, and Africa—the Cypriot people have kept their individuality while still assimilating other cultures. The bowls, jugs, vases, religious idols, and jewelry show the influence of many peoples while remaining typically Cypriot. Assembled under the direction of Donald Whitcomb, assistant curator of Middle Eastern archaeology and ethnology. Exhibit designer was Clifford Abrams. This is the show's last stop before returning to Cyprus. Because of the extreme age and fragility of the objects, this exhibition will not travel to the United States again. "Treasures of Cyprus," developed by the Smithsonian Institution Traveling Exhibition Service (SITES), is sponsored by the government of Cyprus and organized by Vassos Karageorghis, director of the Department of Antiquities, and Patroclos Stavrou, undersecretary to the president of Cyprus. Through Sept. 16. Hall K.

### Continuing Exhibits

**"Art Lacquer of Japan."** Our newest permanent exhibit. Features *inro* (intricately carved and decorated sectional medicine cases), *netsuke* (tiny carved pendants), and *ojime* beads, which hung from the waists of 18th- and 19th-century Japanese men as symbols of wealth and status. Miniature landscapes, dreamlike still lifes, and mythic dragons are flawlessly carved into lacquer ornaments no larger than a matchbox. Examples of Chinese lacquer art are exhibited for comparison. Hall 32. Designed by David Edquist under the direction of Bennet Bronson, associate curator of Asian archaeology and ethnology.

**"Feather Arts: Beauty, Wealth, and Spirit from Five Continents."** Closes July 31. Last weeks to see acclaimed exhibit of 260 rare feather objects assembled almost entirely from Field Museum's own collections. Compare an intricate feather mosaic cloak from New Zealand with sophisticated Chinese jewelry inlaid with brilliant blue kingfisher feathers or with colorful feather adornments from South America's Indian tribes. Learn about the amazing structure of feathers and how they are used to express man's ideas about beauty, wealth, and spirit. Assembled under the direction of Phyllis Rabineau, custodian of the anthropology collections. Exhibit designer: Clifford Abrams. After its closing here, "Feather Arts" will travel to three other museums across the country. Hall 26.

**"The Art of Being Huichol."** A major traveling exhibition of more than 150 objects of Huichol Indian art. The exhibit was organized by the Fine Arts Museums of San Francisco and is sponsored by a grant from the National Endowment for the Arts and by the Museum Society of the Fine Arts Museums of San Francisco. Designed by Don Skinner, the exhibit includes costumes, votive objects, weavings, embroidery, beadwork, and yarn "paintings." The "art of being Huichol" is the act of living a devout life, and spiritual themes dominate their art. The Huichol also value visionary experiences produced by the hallucinogenic peyote and these images are reflected in their dramatic yarn paintings. The Huichol live in an isolated area of Western Mexico, and they remain one of the few traditional Indian groups whose ancient beliefs and practices remain unchanged even today. Through Sept. 3. Hall 27.

**The Place for Wonder.** This gallery provides a place to handle, sort, and compare artifacts and specimens. Earthquake Charlie, the Museum's new one-ton polar bear, is the room's most recently installed "wonder." Weekdays, 1 p.m. to 3 p.m.; weekends, 10 a.m. to noon and 1 p.m. to 3 p.m. Ground floor, near central elevator.

*(Continued on back cover)*

Prepare for the new exhibit on view
June 14 through September 16 by purchasing
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TREASURES OF
CYPRUS

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Chicago, Illinois 60605

Shipping and handling is 75¢ per copy.

# July, August, and September at Field Museum

*(Continued from inside back cover)*

### Continuing Exhibits

**"Cash, Cannon, and Cowrie Shells: The Nonmodern Moneys of the World."** A fascinating collection that contains over 80 varieties of money used by ancient cultures. It explores the origins, values, and meaning of nonmodern money in terms of buying power for these past civilizations. The accompanying text gives the value of each form of money in terms of how much food it could then buy. Four general categories of moneys are on display: metal coinage, uncoined metal, shell money, and "miscellaneous," which includes food, fur, fiber, glass, teeth, and stone currencies. No closing date. Between Halls K and L, ground floor.

**"A Stamp Sampler: Postage from Natural History."** A one-case exhibit that combines 63 natural history specimens with samples of philatelic, or stamp, art. Planned on a rotating basis to cover the four disciplines of natural history, the exhibit in its first phase is devoted to zoological specimens and their images on stamps. Exquisite seashells, butterflies, a leaping jaguar, and fox are among the specimens mounted in the second floor lounge. "A Stamp Sampler" was conceived by Col. M. E. Rada, exhibit guest curator, and designed by Peter Ho, a University of Illinois graduate student.

**Friend or Foe? The Natural History Game.** The object here is to determine which one of apparently similar specimens is harmful and which is not. See if you can distinguish a vampire bat, a headhunter's axe, a poisonous mineral, or a deadly mushroom from its benign look-alike. Ground floor, no closing date.

**The Hall of Chinese Jades** contains beautiful jade art spanning over 6,000 years of Chinese history. An exhibit in the center of the hall illustrates ancient jade carving techniques. Hall 30, second floor.

**American Indian Halls** trace the anthropological history and cultural development of the original Americans, from the time of their arrival on the North American continent (before 20,000 B.C.) to the present. Hall 5 contains a traditionally made Pawnee earth lodge—the home and ceremonial center of Pawnee Indians as it existed in the mid-1800s. Halls 4 through 10, main floor east.

**Tibetan Culture** can be explored in Hall 32, on the Museum's second floor. Rare film footage, shot in 1927, documents nomadic life and religious pageantry in Tibet. The Tibetan exhibits are divided into two sections. One hall displays common possessions from the past such as weapons, yak-herding equipment, and textiles. Lamaism, the Tibetan form of the Buddhist religion, is the theme of the second hall.

### New Programs

**"Summer Fun: Field Museum Workshops."** A series of workshops for young people ages 7 through 14, which highlight museum exhibits of special interest and provide a fun, workshop experience. Enrollment is limited and advance registration is required. The fee is $3.00 for Members; $4.50 for nonmembers. Workshop supplies are provided. All workshops begin at 10:30 a.m. and are two hours long. Handicapped participants are welcome and special arrangements for the hearing-impaired have been made for selected workshops. For more information and registration forms, call 922-9410, ext. 364.

**"Drawing Dinosaurs."** Learn about drawing and dinosaurs by sketching these prehistoric creatures from the Museum's skeletons and dioramas. Open to ages 7 to 13. Sessions meet on Tuesday, July 17 and on Wednesday, July 18.

**"Ojos de Dios (God's Eyes)."** After visiting the Huichol exhibit, young people learn how to make their own version of this ancient Mexican good luck charm. Open to ages 9 to 14. Session meets on Tuesday, July 17.

**"Egyptian Hieroglyphs."** Learn to write your name in this ancient symbolic script. Open to ages 9 to 14. Sessions are Thursday, July 19, and Tuesday, July 24.

**"Fiber to Fabric: Spinning, Weaving and Dyeing."** After examining the Museum's displays of textiles from different societies, the class learns how to spin fiber into thread, to weave thread into fabric, and to dye fabric in various colors. Open to ages 9 to 14. Session meets on Thursday, July. 19.

### Continuing Programs

**Summer Journey: "A to Z at Field Museum."** Self-guided tour leads families and children through a cross section of exhibits introducing them to the Museum's four main areas: anthropology, botany, geology, and zoology. Free *Journey* pamphlets available at the North Information Booth, and the South and West doors.

**On Your Own at Field Museum.** Self-guided tour booklets, adult- and family-oriented, are available for 25¢ each at the entrance to the Museum Shop, main floor north.

**Weekend Discovery Programs.** Guided tours, demonstrations, and participatory activities. Every Saturday and Sunday, 10 a.m. to 3 p.m.

**Volunteer Opportunities.** Limited opportunities are available in botany, geology, and zoology. Weekend volunteers with an interest in natural history are needed to develop and present weekend programs. For more information call 922-9410, X 360.

**July, August, and September Hours.** In July and August, the Museum is open daily 9 a.m. to 6 p.m. except Fridays. In September, the hours are 9 a.m. to 5 p.m. On Fridays, throughout the year, the Museum is open 9 a.m. to 9 p.m.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at the reception desk, main floor. Closed Labor Day.

**Museum Telephone:** (312) 922-9410

September
1979

# FIELD MUSEUM OF NATURAL HISTORY BULLE

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of Natural History
Bulletin

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*Late summer scene in Manistee National Forest, Michigan. Photo by Robert Brudd, Tinley Park, Illinois. On Ektachrome, using Cambo 4x5 view camera.*

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# FIELD BRIEFS

### Environmental Field Trips

Thirteen field trips to take place in September and October will offer nonmembers as well as members new opportunities to learn about the local flora, fauna, and geology. Under sponsorship of the Ray A. Kroc Environmental Education Program, the trips will be led by Field Museum staff and guest scientists.

Sites to be visited include Goose Lake Prairie, Braidwood Dunes and Savannah, McGraw Wildlife Foundation, Morton Arboretum, Kane County Farms, and Starved Rock State Park. Both adult trips and family trips are being scheduled; early registration by mail is strongly recommended.

Field Museum members automatically receive the field trip brochure with trip dates and registration form. Nonmembers may receive a brochure by calling 922-9410, ext. 362, or writing: Department of Education—Field Trips, Field Museum, Roosevelt Road at Lake Shore Drive, Chicago, IL 60605.

### Donald J. Stewart Appointed

Donald J. Stewart has been named assistant curator of fishes. A native of Omer, Michigan, he holds a Ph.D. from the University of Wisconsin. He did his undergraduate work at the University of Michigan, where he also received his M.A. Stewart most recently served as research assistant for the University of Wisconsin Marine Studies Center, at Madison.

He has done extensive field work in both eastern and western Africa. His technical papers include a number of publications on fresh water fishes of these areas, notably on cichlids and cyprinids.

### Erik K. Waering, Carl L. Hubbs

Erik K. Waering, a Field Museum research associate in geology since 1958, died July 16 in Naples, Florida. He was 67. Formerly a geologist for Amoco International Oil Co., Waering was also one of the leading authorities on fossil scorpions, an interest which led to his association with the Museum. He wrote prolifically and had recently completed a definitive monograph on the subject.

Carl L. Hubbs, who served as Field Museum's assistant curator of fishes 1916-20, died in La Jolla, California, on June 30. He was 85. After leaving Field Museum, Hubbs went on to become one of the world's leading ichthyologists. He was professor emeritus of biology at Scripps Institute of Oceanography and founding director of Sea World, at San Diego. During his long and productive career, Hubbs wrote more than 700 books and technical papers on fishes.

### "Feather Arts" Catalog Cited

The "Feather Arts" catalog, published in conjunction with the recent exhibit *Feather Arts: Beauty, Wealth, and Spirit from Five Continents*, has received the 1979 award for excellence from Chicago Women in Publishing. The catalog was written by Phyllis Rabineau, custodian of the anthropology collection and organizer of the exhibit, and designed by Clifford Abrams, of the Department of Exhibition. Patricia Williams, managing editor of scientific publications, was the editor.

The 88-page catalog, with many four-color plates, was judged on the basis of purpose and subject, writing and editing, design and graphics, and manufacturing. A member of the judging committee observed that the catalog was "a piece of art—as anything from the Field Museum should be."

Catalog designer Clifford Abrams also received an award from *Print* magazine for his design of the exhibit, which closed July 31. His design will be featured in *Print Casebook No. 4*, published by *Print*.

The "Feather Arts" catalog is available at the Museum Shop for $7.95 (10% discount for Members). Mail orders should be directed to the Museum Shop and include 50¢ additional for postage and handling.

### Weekend Members' Tour to Galena October 12, 13, 14

Spaces are still open on Field Museum's weekend tour to historic Galena, Illinois, in the northwestern corner of the state. A century ago the small city was a bustling lead-mining center and many of the fine homes of that era are still preserved. Geologic features of the region continue to be of particular interest. Dr. Bertram G. Woodland, curator of petrology, who will serve as tour leader, will also provide commentary on the unusual geologic features of the area.

Accommodations for two nights will be at Chestnut Mountain Lodge. Price of the tour is $150.00 per person, double occupancy (singles on request). Included are all expenses of transportation on charter buses to and from Chicago; all meals and gratuities, except personal extras such as special food service. Advance deposit: $15.00 per person. For further information call or write Michael J. Flynn, Field Museum Tours, Roosevelt Rd. at Lake Shore Dr., Chicago, Ill. 60605. Phone 922-9410, ext. 251.

*Illustration from "Feather Arts" catalog*

# *El Niño: The Catastrophic Flooding of Coastal Peru*

## A complex of oceanographic and meteorologic factors combine in one of Earth's most devastating, recurrent disasters

### Part II

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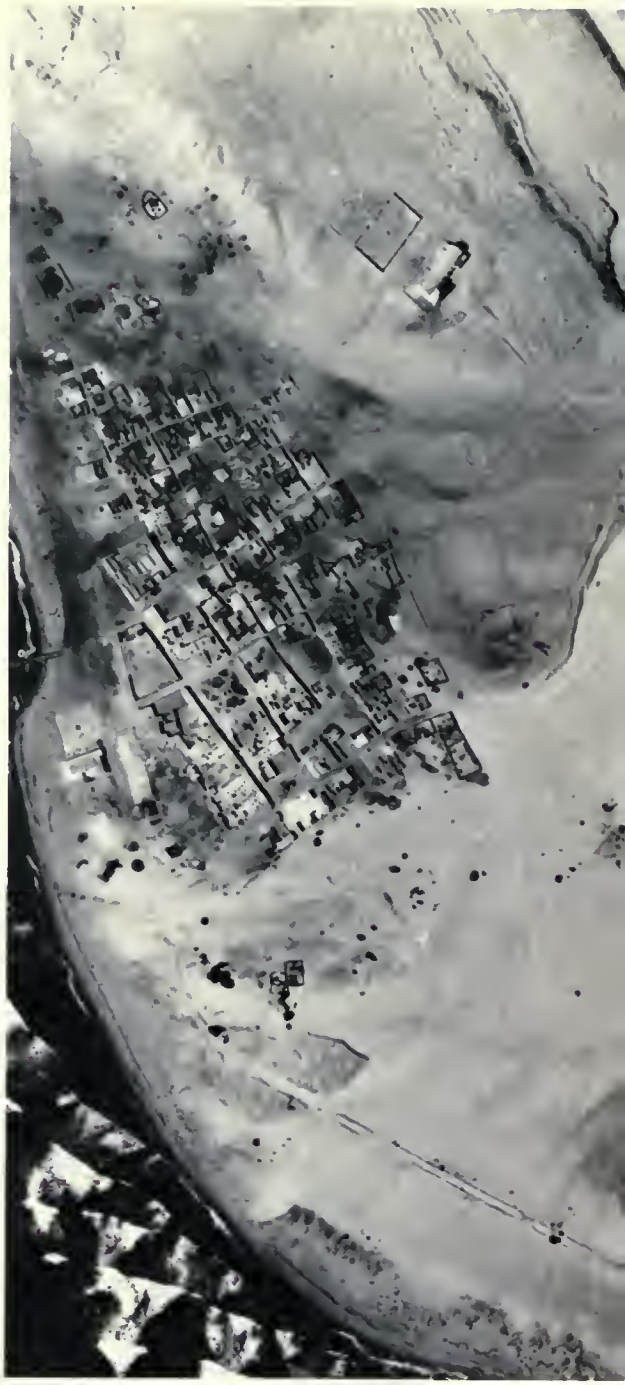
*BY* FRED L. NIALS, ERIC E. DEEDS, MICHAEL E. MOSELEY, SHELIA G. POZORSKI, THOMAS G. POZORSKI, *AND* ROBERT FELDMAN.



Part I (July/August *Bulletin*) summarized the complex conditions that periodically combine to create el niño, described the nature of human occupation of the Moche Valley (beginning some 12,000 years ago), and sketched the ingenious irrigation system devised by the valley's early inhabitants. The rise and fall of irrigation systems in the valley are currently the subject of intensive study by Field Museum's Michael E. Moseley and Robert A. Feldman and other members of the *Programa Riego Antigua*, or *PRA* (Ancient Irrigation Program).

#### THE QUEBRADA RIO SECO

During 1978, staff scientists combined forces in a concentrated effort to move beyond the archaeological findings and use geological evidence to evaluate the existence of a large pre-Columbian flood. The Quebrada Río Seco and the Río Moche were chosen for intensive study because they would register different sources of runoff, and because they contained prehistoric remains that could be dated and cross-correlated with erosional features. The challenge of the undertaking was the lack of any known geologic methods for distinguishing one niño flood from another, to say nothing of comparing magnitudes of different inundations.

Survey in the Río Seco revealed silts and fine-grained flood deposits typical of channel margins in many localities and at varying heights above channel bottoms. The excellent preservation and lack of differential weathering of these deposits proved to be a problem because all the deposits looked identical and sediments resulting from the 1925 niño could not be distinguished from those of earlier or later floods. Recognition of the extent of the 1925 flood was critical because it was the largest known water flow since Spanish colonization. Unless the margins of this flood could be distinguished, no basis existed for comparison with earlier floods.

Careful examination of ground and aerial photographs taken in 1926, 1942, and 1969 revealed

---

*Fred L. Nials is a geologist at Eastern New Mexico University who specializes in archaeological applications of geology. Eric E. Deeds is a Harvard senior who, as a PRA consultant, first identified the effects of the Chimu flood. Michael E. Moseley, codirector of the PRA, is associate curator of Middle and South American archaeology and ethnology at Field Museum. Shelia and Thomas G. Pozorski, codirectors of the PRA, are on the staff of the Carnegie Museum of Natural History, Pittsburgh. Robert A. Feldman is a research archaeologist with the Field Museum's PRA.*

that the boundaries of the 1925 flood could be precisely identified in most areas by comparing erosional features and aeolian deposits inside and outside the channels. Small coppice dunes were particularly important because many of the individual dunes appearing in photographs made as early as 1926 could still be recognized and identified 52 years later! Dunes that may have been present in channels during the 1925 inundation were either completely washed away or were truncated by erosion along the channel margins. The sequence photos also revealed that by 1942 no new coppice dunes had formed in the channel bottoms flooded during 1925. Thus, by examining the distribution of these little sand dunes it proved possible, in most areas, to delineate the exact margins of the largest flood to have come down the Río Seco since the Spanish arrived.

Continuing survey showed that throughout the quebrada, fine-grained flood deposits were consistently present at levels higher than the 1925 sediments. These high-level deposits were often capped by coppice dunes. To demonstrate that the sediments belonged to the Chimu cataclysm depended upon accurately dating them, and upon making sure there had been no significant changes in the braided drainage of the quebrada.

The Río Seco was extensively farmed by the Chimu, who constructed numerous canals, roads, and walls across the wash. Within the flood plain they also built the town of Cerro La Virgen. The settlement straddled a large road that ran up the north bank of the quebrada, and then crossed over culverts of a large canal. Survey and excavation demonstrated that the canal had been destroyed by the Chimu flood. The interconnecting road indicated that the canal and the town had once been in contemporary use; therefore, the settlement should also have been impacted by the deluge. Survey of the ruins showed many areas buried by flood sediments deposited at higher levels than the margins of the 1925 inundation. Excavations revealed that the

**Figs. 1, 2.** *Photo at left is aerial view (1942) of the coastal village of Huanchaco, located at mouth of Río Seco. Lighter area in left view is that eroded by 1925 niño's flood. Photo at right, taken in 1970, shows occupation of 1925 flood area by new buildings—summer homes of Trujillo and Lima residents. If flooding reccurred here —as it certainly will— the destruction would be enormous.*

flood sediments immediately overlay room floors and occupational remains; this indicated that the town was inhabited at the time of inundation and then abandoned. By using evidence of ancient canals, roads, walls, and coppice dunes in other regions of the Río Seco, it was possible to date additional high-level flood deposits to Chimu times and cross-tie them to the ancient disaster that befell the inhabitants of Cerro La Virgen.

The next problem confronting the geological staff was possible alterations in the quebrada drainage pattern. The coastline has undergone some 6 to 8 meters of uplift during the past several thousand years, and when vertical displacement occurs, the gradient of a stream, such as the Río Seco, is locally steepened adjacent to the coastline. This causes water to flow faster in the steepened portion, with a resultant downcutting and entrenchment of the stream. The steepened portion will erode upstream until the entire stream system becomes entrenched and adjusted to the new level. If downcutting had occurred in the Quebrada Río Seco during or since the Chimu flood, it would make all floods following downcutting appear to be smaller in volume, because the channels would be deeper and consequently hold more water.

Gravel-quarrying operations have almost completely obliterated the lowermost 1½ kilometers of the Río Seco, so that traditional geologic methods of comparing terrace gradients as a means of checking for downcutting could not be applied. Fortunately, archaeological evidence provided clues. In numerous instances remnants of canals, walls, and other manmade features were found in the bottoms of channels, which indicated that virtually no downcutting had occurred except in the lowermost reaches of the quebrada. Also, some of the canals crossing the quebrada were graded to the level of existing channel bottoms, so that gravel bars between channels were trenched to the same level as the channels on either side. Examination of the canals and channels showed that all were still at essentially the same level. Downcutting could therefore be eliminated as a complicating factor in the comparison of floods.

A knottier problem was caused by the type of drainage pattern. Since the normal flow in these streams is in the form of multiple, shallow, relatively impermanent channels, it was possible that the stream had merely shifted course slightly and diverted more water down one channel than another for some period of time. Deposits and erosional features in the channel receiving the diverted water would thus indicate higher volumes of flow. If water were repeatedly diverted to other channels, most of the channels would then seem to have been affected by a large flood, although this was actually not the case. Once more, a close comparison of floods seemed highly problematical. Archaeological evidence again provided a resolution of the problem. Closely spaced parallel walls and canals crossing the Río Seco allowed comparison of each channel in relation to an archaeological feature of known age. By using this method of examination the possibility of diversion from one channel to another was eliminated in most cases. Indeed, the bulk of evidence suggests that little shifting of channels has occurred during or since the Chimu flood. This method also effectively counters the arguments of lateral erosion and damming as factors in erosion of early archaeological features.

Unfortunately, the nature of the evidence allows comparison only between the 1925 flood and the largest flood prior to that time. Deposits of intervening floods have either been eroded away or buried by younger deposits. The 1891 flood, also reportedly of large magnitude, could not be recognized on the basis of geological evidence. The nature and number of channels, and the destruction of the lower reaches of the quebrada make calculation of peak flow during the Chimu flood difficult. Very conservative initial estimates of the Chimu flood indicate a peak flow at least two to four times the size of the 1925 inundation. No means of estimating the duration of flow of either flood exists.

Geological and archaeological evidence from the Quebrada Río Seco clearly demonstrates the occurrence of a large-magnitude Chimu flood which affected drainages receiving locally derived runoff.

## The Río Moche

The lands along the north side of the Río Moche are intensively farmed, and this has obscured evidence of past flooding. However, south of the river where there is less agricultural development, we find good preservation of geological and archaeological features relating to the Chimu flood. Two localities are particularly important, the Hacienda Santo Domingo area near the valley neck, and the Moche capital at Huaca del Sol.

Early in the 1600s Spanish looters looking for ancient treasure diverted the Río Moche against the west side of Huaca del Sol, undercutting and washing away more than half the mud brick mound. This destruction left a large architectural profile that by chance was photographed in 1925 as the niño flood waters began to recede. This photograph (*Fig. 7, in Part I, p. 12*), provides reference points for the height of the inundation, the base of the mound, and the plain upon which it was built. The plain that passes beneath Sol and stretches east to the foot of Huaca de la Luna was once covered with buildings. In 1972 we opened a series of excavations there. Moche Phase archaeological deposits reached a depth of 7 m on the east side of the Sol platform, while their depth near the foot of Huaca de la Luna was about 2.5 m. Midway between the two mounds we found a wide, low platform. Sand and refuse had accumulated around the sides of this adobe structure, and its flat top was at about the same level as the surrounding surface. While the platform was in use, Moche burials with subphase III and IV pottery were built into it. Long after abandonment, the mound was reused as a cemetery by Chimu people who made pottery dating no later than the middle brick phase at Chan Chan. However, prior to Chimu reuse the adobe structure had been completely saturated with water to the point that the bricks reverted to a muddy consistency and upon drying encased the Moche burials in a solid adobe matrix. The Chimu graves were cut into resolidified structure and the fill of broken adobe and sand around these burials was loose and had not been water consolidated.

The differences in soil matrices around the two sets of burials clearly indicated that massive wetting had occurred after Moche subphase IV times, but before the end of middle Chimu times. In 1972 we had great difficulty in accounting for the obvious soaking of the site. Even heavy rainfall from a strong niño would not have produced sufficient local runoff to have saturated the central platform between Huacas Sol and Luna.

During the geological studies of 1978 the situation was reassessed. Survey upstream from Sol located laminated silt flood deposits, datable to early Chimu times, more than 8 m above the modern river level. Similar deposits were then identified in front of Huaca de la Luna, where they overlay Moche phase archaeological deposits. The site had been saturated by extremely high river waters. The flood deposits in front of Luna were more than 15 m above the present river level, and more than 8 m above the height of the 1925 inundation. Because the river floodplain is very broad in the region of Huaca del Sol, the Chimu inundation was of staggering proportions. In the central valley the swollen river probably attained a maximum flood width of nearly 4 km and a depth exceeding 15 m. These calculations of magnitude are supported by other lines of evidence from the Hacienda Santo Domingo area.

The Hacienda Santo Domingo area is located on the southern margin of the Río Moche approximately 8 km upstream from Huaca del Sol (*Fig. 3*). The most vivid evidence yet seen of the magnitude and erosive capability of the Chimu flood is present in this area.

A broad, relatively flat bench varying from .5 to 1 km in width and approximately 1.5 km in length parallels the Río Moche between Quebrada Ancados and Hacienda Santo Domingo. The bench surface averages 12-15 m in height above the present river level and is separated from the river by a steep escarpment of similar height. A narrow belt of sand dunes containing Early Chimu archaeological materials caps the escarpment along the upstream half of the bench (*Fig. 5*), and other dunes are present on the downstream end of the bench. The central portion of the bench is devoid of aeolian sand and archaeological materials except for several sandy hummocks up to 6 m high which contain Early Chimu artifacts. These sandy hummocks are teardrop-shaped, with the blunt end facing upstream.

Stratigraphic investigations near the down-

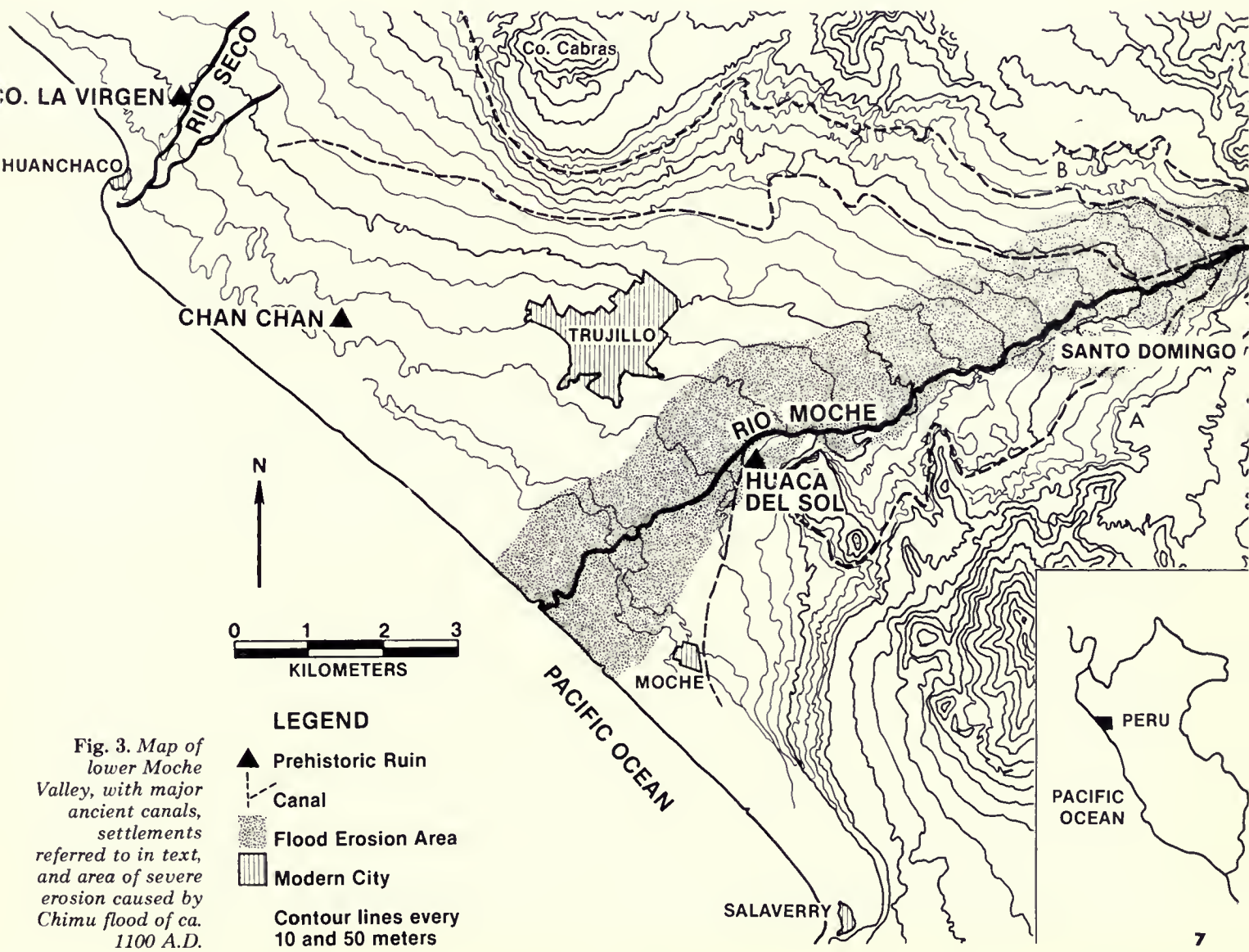



Fig. 3. *Map of lower Moche Valley, with major ancient canals, settlements referred to in text, and area of severe erosion caused by Chimu flood of ca. 1100 A.D.*

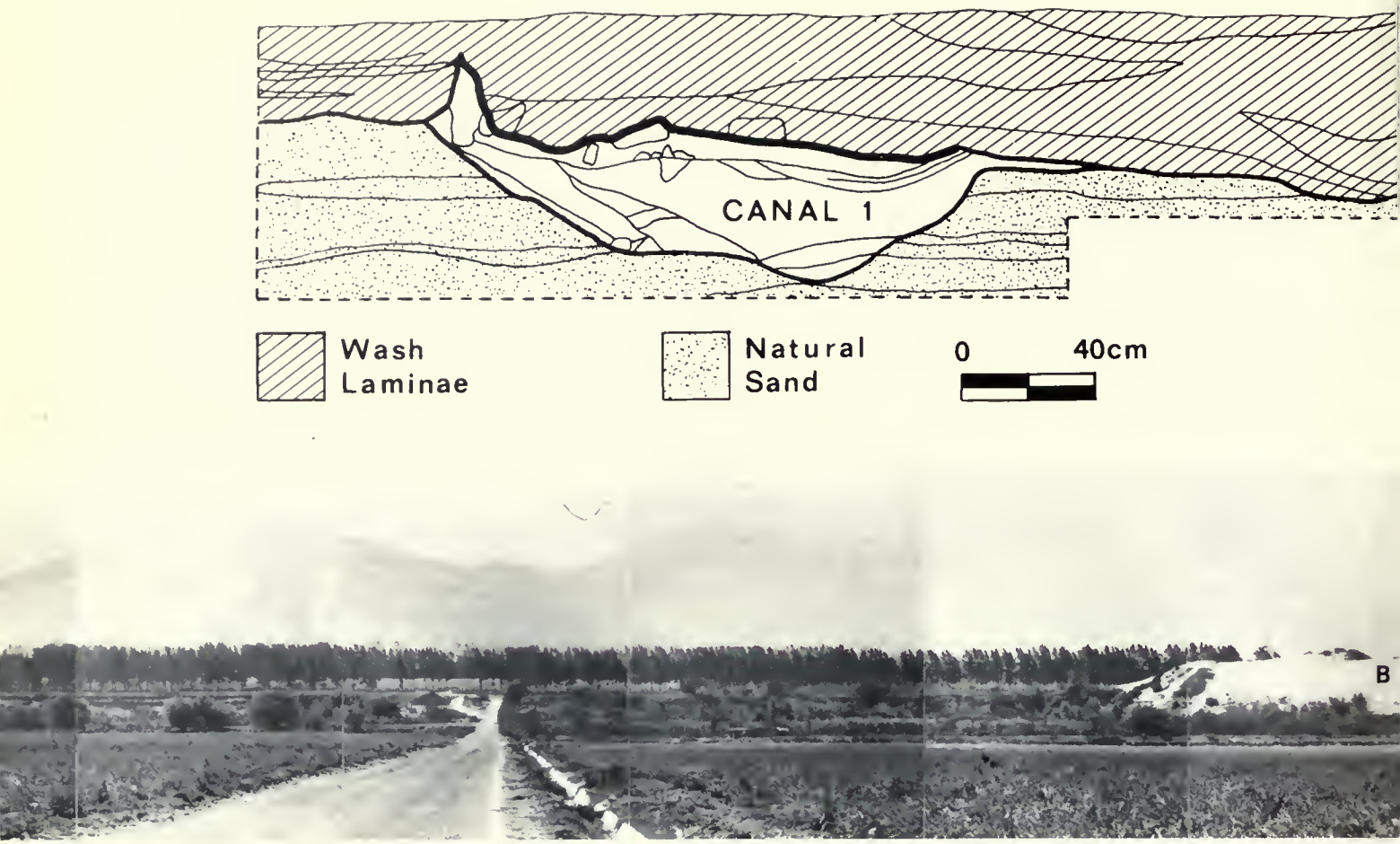



Fig. 5. *Above and right: Left and right portions, respectively, of composite photo showing river bank near the Santo Domingo area (see map, p. 7). The uppermost alluvial sediments (A) east (right) of the sand dunes (B) were eroded away by waters of the Chimu flood. The entire bluff face was created by the same flood, whose waters were about 15 m (49 feet) above the present river level.*

stream end of the bench revealed that the uppermost strata were missing from the bench and that the stratigraphy of the sandy hummocks was identical with stratigraphy upstream and downstream from the bench. Clearly, massive erosion stripped the uppermost 4-6 m from the surface of the bench.

Examination of aerial photographs revealed the mechanism of erosion. The Río Moche had risen to a height sufficient to overtop the bench and to breach the dunes bordering the river. The central portion of the bench was stripped by these flood waters, and the sandy hummocks were left as islands during the flood.

Calculation of peak flow is difficult because it is impossible to determine the exact level of the river prior to flood. The area had been uplifted 6-8 m prior to flooding, and downcutting of similar magnitude should have occurred prior to or during the flood. An extremely conservative estimate, allowing for no prior downcutting and a riverbottom level 10 m above the present one, requires flood waters to have been at least 18 m deep in the central portion of the valley. Width of the river during maximum flood stage at this location would have been approximately 3.5 km. These figures become even more impressive when it is realized that the annual rainful for this location averages less than 12 mm.

Was the flood recognized at Huaca del Sol and Hacienda Santo Domingo the same Chimu flood described at Quebrada Río Seco? Evidence at Huaca del Sol places the flood during Chimu time. Early Chimu sites on the Santo Domingo bench have been eroded and removed. A middle brick phase Chimu site constructed on the sand dunes at the edge of the bench extends across areas stripped by the flood,

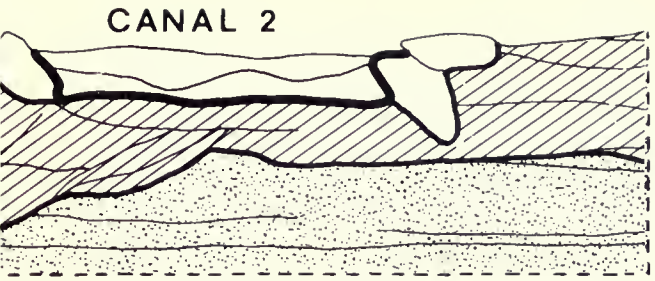



**Fig. 4.** *Excavations across the canals clearly show the Chimu niño's destruction. The pre-flood Canal 1 was partially washed away, then buried under nearly 50 cm (20 in.) of flood wash. The reconstruction phase waterway, Canal 2, was built at the level of the present surface and stone lined for added strength.*

but shows no sign of erosion or melting of adobes. The pieces of evidence place the flood between early and middle Chimu brick phases, the same period as the flood on the Quebrada Río Seco. Even though large floods can occur on the Río Moche in non-niño years, events of 1925 indicate that the largest known floods are the result of niños. While it is not possible to definitely say that the Río Moche flooding described was the result of the same niño responsible for Quebrada Río Seco flooding, it is extremely unlikely that two different floods of such unusual magnitude should occur within such a limited period of time.

## Summary Implications

There is conclusive evidence that a flood of unusually large magnitude occurred early in the Chimu dynasty, within a century of the year 1100 A.D. Its effects were particularly devastating. Because the volume of discharge was extremely high and because tectonic uplift had occurred prior to the flood, the large volumes of water triggered river downcutting and eroded away significant portions of the central valley, destroying the irrigation system and modifying patterns of soil drainage, thus eliminating much of the agricultural resource area.

The peak discharge of the river and quebradas is difficult to determine. However, a very conservative estimate would be flood waters at least 2 to 4

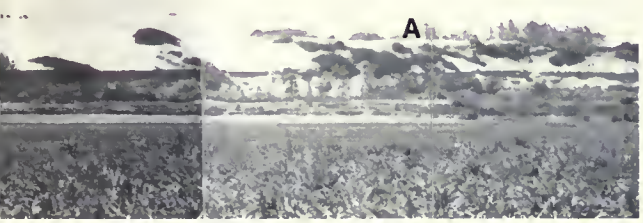
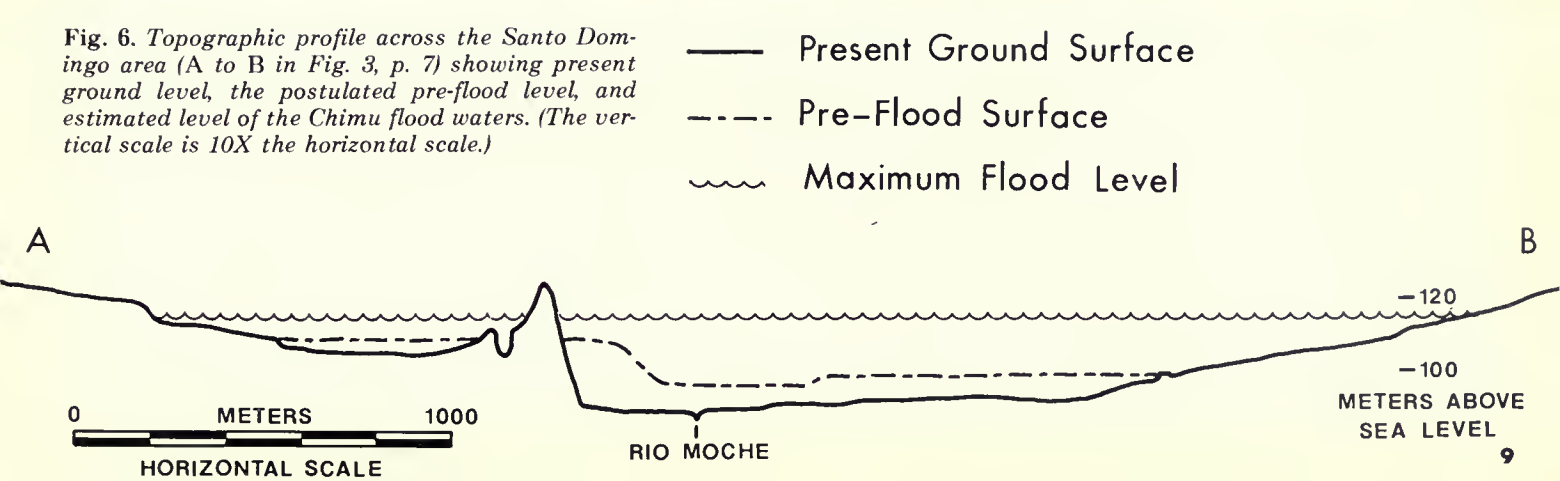


**Fig. 6.** *Topographic profile across the Santo Domingo area (A to B in Fig. 3, p. 7) showing present ground level, the postulated pre-flood level, and estimated level of the Chimu flood waters. (The vertical scale is 10X the horizontal scale.)*



times the size of the 1925 floods, the worst in the last 400 years. The Chimu flood was undoubtedly the result of a particularly intense niño, because niños are the only known mechanism for producing significant rainfall along the coastal desert. Niños are known to be recurrent phenomena, and the Chimu flood indicated that the 1925 niño was not some unusually severe quirk of nature. Indeed, it appears "mild" in comparison to the catastrophe that struck eight centuries earlier.

Was the Chimu flood simply a fluke of nature? Or were there even earlier niños of similar magnitude that might imply a long term pattern of recurrence? These are truly pressing questions of general concern. Documenting the Chimu inundation was a demanding task made possible by unusually good preservaton of geological and archaeological features afforded by the normally dry desert. Field Museum scientists are currently evaluating new methods for determining the presence and frequency of strong niños in the past. This is imperative because there appears to be evidence in the Moche Valley of another large flood that occurred about 500 B.C. If this flood is verified, it would strengthen the probability that the Chimu flood was not unique, and therefore call for some serious concern for what the future may bring.

Planning for such an eventuality is perplexing. At a global level, destruction of the fishing industry would require attention to alternate sources of protein. At a national level, Peru would face even greater complexities. It would be financially infeasible to construct roads, canals, and dams capable of withstanding floods of the Chimu magnitude. Yet, there would have to be some civil defense strategy to minimize devastation and loss of life. Because the coastal population has grown so rapidly, little thought has been given to the location of new or expanding settlements, many of which are built squarely across large quebradas. Centuries ago floods in the Río Seco destroyed the Chimu town of Cerro La Virgen. At the mouth of the quebrada the 1925 floods lapped the fishing village of Huanchaco. Today, Huanchaco is a summer resort that has grown across the mouth of the Río Seco (*Figs. 1, 2*). Even a flood of the 1925 magnitude would be disastrous, but an inundation of Chimu scope would bring near total destruction.

Long ago the Spanish recorded a "legend" of more northerly Chimu people who were once early rivals of Chan Chan. They were a powerful nation until their king incurred the gods' wrath, and as punishment it rained for 30 days and nights. Devastating flooding ceased only when the populace rose up, bound the king hand and foot, and threw him into the ocean. There followed great famine and pestilence, lasting for countless years, and then Chan Chan's armies swept across the land, conquering all. A modern repeat of the Chimu flood could well bring a repeat of this "legendary" scenario entailing revolution, starvation, and eventual foreign domination!

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*The research program reported above has received major financial support from the National Science Foundation, with additional funding from the Frederick Henry Prince Trust and from Mrs. Gatzert Spiegel. Logistic support in the form of equipment and personnel was provided by Soiltest, Inc., of Evanston, Illinois, through Mr. Theodore W. Van Zelst.*

Stanton R. Cook, courtesy *Chicago Tribune*

*Portion of the Temple of Heaven, Peking, built in 1420, one of many sites awaiting members of Field Museum's November tour to China. (See tour description on facing page.)*

# Field Museum Tours

**Peru, Oct. 27-Nov. 15.**

A 20-day tour will visit the ruins of Machu Picchu, Chan Chan, Pachacamac, Purgatario, and others. The Plains of Nazca (viewed from low-flying aircraft), the Guano Islands, and the Pisac Indian Fair will also be visited. The group, limited to 20, will be led by Dr. Michael Moseley, associate curator of middle and South American archaeology and ethnology, and by Robert Feldman, assistant in archaeology. A tour escort will also accompany the group.

The tour cost—$2,998 (which includes a $500 donation to Field Museum)—is based upon double occupancy and includes round trip air fare between Chicago and Peru and local flights in Peru. Delta Airlines will be used between Miami and Chicago, connecting with Aeroperu. Deluxe accommodations will be used throughout. The package includes all meals, including inflight meals; all sightseeing; all admissions to events and sites; all baggage handling; all necessary transfers; all applicable taxes and tips; all applicable visa fees. Advance deposit: $250.00 per person.

**China, Nov. 5-25**

Peking's Forbidden City, the Summer Palace of the Dowager Empress, the bustling activity of Canton, the ancient pagodas of Kunming. These are just a sampling of the sights that lie in store for the 23 persons (Field Museum members and their families) who visit China on Field Museum's exclusive tour this November.

In addition to fourteen days in China, three days and two nights will be spent in London. The tour escort will be Mrs. Katharine Lee, a Field Museum volunteer in the Department of Anthropology who is fluent in five Chinese dialects. Additional guides in China will be provided by the China International Travel Service. The tour cost—$4,400 (which includes a $500 donation to Field Museum)—is based upon double occupancy and includes round trip air fare from Chicago to China. Advance deposit required: $500.00 per person.

**Antarctica, Jan. 6-30, 1980**

Until recently, only explorers were able to view antarctica's wondrous beauty. There is no destination more remote, more unspoiled by the encroachments of civilization. Our itinerary includes the Falkland Islands, a visit to the Patagonian coast, the South Georgia Islands, the South Orkney Islands, and of course, antarctica. Dr. Edward Olsen, curator of mineralogy, will be tour lecturer.

The cruise vessel will be the 3,200-ton ship *M.S. World Discoverer*, registered in Hong Kong, which will take us from Punta Arenas, Argentina, onwards. Built in 1974, the one-class vessel has all outside cabins with private lavatories and showers. The ship's staff includes a fully qualified physician. The tour leaves Chicago Jan. 6, 1980 and returns Jan. 30. Prices per person: C deck twin: $3,230; C deck single: $4,870; B deck twin: $3,570; B deck single: $5,390; A deck twin: $3,930. Air fare, in addition is $1,225 (round trip between Chicago and Punta Arenas, Argentina). Included in the tour price is a tax-deductible donation of $500.00 to Field Museum. Deposit required at time of registration: $1,000.00 per person.

**Archaeological Tour of Egypt with Nile River Cruise Jan. 31-Feb. 17, 1980**

Field Museum once again presents its popular Egypt tour with a Nile River cruise. This is the fourteenth such tour offered to Members during the last four years. The new and improved program offers an 11-day Nile cruise on our own chartered, private, modern Nile steamer. In addition, we will be visiting Cairo, Memphis, Sakkara, Aswan/Abu Simbel, Edfu, Esna, Kom Ombo, Luxor, Thebes, Valley of the Kings and Queens, Dendereh, Abydos, Amarna, Middle Kingdom Tombs at Beni Hasan, Pyramid at Medum, and much more.

Eighteen days exploring Egypt with our Egyptologist, Mrs. Del Nord, a doctoral candidate at the Oriental Institute of the University of Chicago, who has traveled extensively in Egypt. Leave Chicago on January 31, 1980, and return on February 17. Price includes all air transportation, meals, Nile cruise, hotels, tips, taxes, transfers, visa fees, admissions, baggage handling, escorts, and more. $3,595.00 per person based upon double occupancy. The tour price includes a $500.00 contribution to the Field Museum. A $500.00 per person deposit is required for reservation confirmation. The group is limited to 30 persons. Single supplement is available upon request, Nile Cruise and land.

**Kenya Safari Feb. 13-March 5, 1980**

The wildlife of Kenya, both plant and animal, will be the focal point of this exciting 22-day tour of Kenya. An added bonus will be one of nature's most spectacular phenomena, a total eclipse of the sun which will occur on Feb. 16, 1980, and which you will view from the perfect vantage point, the Taita Hills. On the tour you will visit Nairobi, Amboseli beneath Mt. Kilimanjaro, Tsavo West, Tsavo East, Mombasa on the Indian Ocean, the Ark, Samburu, Mt. Kenya Safari Club, Lake Naivasha, Masai Mara adjoining the Serengeti, and more.

The tour will be led by Dr. Robert Faden, assistant curator of botany, and his wife, Audrey Joy Faden. Dr. Faden lived in Kenya for more than seven years and is very well versed in the flora. Audrey Faden, a wildlife artist, was born and raised in Kenya and has a first-hand knowledge of the fauna.

The tour leaves Chicago on Feb. 13, 1980, and returns March 5. Price includes all air transportation, meals, transportation within Kenya, hotels, tips, taxes, visas, transfers, baggage handling, admissions, escorts, and more. The tour cost is $4,575.00 per person based upon double occupancy from Chicago; this includes a $500.00 contribution to Field Museum. A $750.00 deposit per person is required for reservation confirmation. The group is limited to 25 persons. Single supplement is available upon request.

*For additional information and reservations for all tours, call or write Michael J. Flynn, Field Museum Tours, Roosevelt Rd. at Lake Shore Dr., Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.*

# Illinois Archaeology Tour
## A Brief Report

By Robert B. Pickering
Tour Leader

*Photos by the author*

THE FAMILIAR TERM "ARCHAEOLOGY," for most, probably brings to mind expeditions to exotic places: the jungles of Yucatan, mysterious Angkor Wat, or Egyptian wonders such as Abu Simbel. But right here in Illinois we also have some highly significant and interesting archaeological sites, as 25 participants in a recent Field Museum field trip will readily attest.

The main purpose of the five-day field trip, which took place during the first week of June, was to give the participants some first-hand knowledge of Illinois' own prehistoric wonders; but the trip was also an opportunity to examine contemporary archaeological theory and methodology and to observe the dangers being posed to prehistoric sites by expanding urbanization and the attendant technologies.

Dickson Mounds, near Lewistown, in west central Illinois, was the first stop on the trip. The Dickson Mounds Museum, built in 1972, is the newest major structure in the Illinois State Museum system; yet it represents one of the oldest continuous archaeology projects in the Midwest and perhaps the country. In 1927, Dr. Don F. Dickson, a

*Robert B. Pickering is a doctoral candidate in anthropology at Northwestern University.*

*Excavation at the Koster site will be filled in during 1979.*

chiropractor, began uncovering on his bluff-top property the physical remains and artifacts of what are now known as Late Woodland and Mississippian peoples. Using his own private funds and those of family and friends, Dickson uncovered a considerable portion of the ancient cemetery there. A remarkable feature of Dickson's work is his approach: he preserved the excavation without removing any of the artifacts, bones, or other material of historic value. Everything was left in situ so that visitors could see these materials in their natural condition. Very early in his excavations, Dickson persuaded some eminent anthropologists to visit his discovery. Fay-Cooper Cole, Thorne Deuel, George Neumann, and other distinguished scientists thus became actively involved in research there.

*John White makes fishline cord from sapling bark.*

Today, at Dickson Mounds Museum, we see a combination of traditional and untraditional exhibition. In the traditional vein, there are a number of excellent displays and life-size dioramas which depict aspects of life during the time when Dickson Mounds were being used (*ca.* 1100-1250 A.D.) as well as during earlier periods. The covered cemetery itself is the most fascinating and distinctive portion of the museum facility. One can view the actual excavation then learn more about it by means of a slide presentation and taped program.

Just a few hundred yards south of the main museum building is a cluster of aboriginal dwellings over which structures have been erected in order to better preserve them and facilitate their viewing. Although construction materials used by the Eastern Woodland Indians (frameworks of wooden poles and daub-covered branches, roofs of grass or bark thatching) do not preserve well, it is possible to see the burned remains of 900-year-old buildings and to learn something of their construction and use.

The second leg of the archaeological tour was to the Kampsville area, not far from the confluence of the Illinois and Mississippi rivers. Kampsville is the center of activity for the Foundation for Illinois Archaeology, which is involved in archaeological research throughout the Lower Illinois River Valley. Most famous of the sites in this region is Koster—the subject of a recent best-seller by Stuart Streuver and Felicia A. Holton (reviewed elsewhere in this issue). Much more than mere excavating goes on in this portion of The Valley. (Capitalization is de rigueur among those initiated early in their careers to the archaeological rites of passage in Kampsville.) Perhaps the most distinctive part of the FIA program is the abundance of laboratories whose staffs not only analyze local archaeological materials but make comparative collections, do experimental work, and train others. The zoology, botany, and palynology laboratories attempt to identify the species of animal remains, plant remains, and pollen, respectively, from soil samples that are recovered archaeologically. What is known of these species as they exist today is then applied to understand how they were useful centuries ago to the Indians.

Experimental archaeology, another Kampsville program, provides information which can be used in interpreting finds and in reconstructing past cultures. Within this sphere are the activities of John White (former Field Museum staff member who was instrumental in development of the Museum's highly acclaimed Pawnee earth lodge exhibit). With his own hands, White creates all variety of utilitarian objects of the sort once used by Indians, from dwellings to fishhooks. The raw materials he uses are gathered from the natural environment and in a manner that has been recorded by ethno-historians.

White and his helpers—often Chicago-area

*Tour members examine replica of Woodland style home constructed by John White and student groups. Plastic covering is for protection against rain.*

school children—have built a number of Woodland houses or lodges out of poles, daub, and thatch—structures that are similar to lodges seen and described by European explorers in the 1700s. We know from the archaeological record that similar types of dwellings were in use by the Indians for many centuries prior to the coming of Europeans. Does this construction work do more than keep a lot of school kids busy? The answer is yes. By building a number of structures, White and his fellow workers have been able to estimate the amount of time which would have been necessary for cutting poles, erecting the frame, the sequence of construction steps, and perhaps even the size of the building team. White also makes items that are much smaller. Tour members watched him deftly cut down a sapling, peel its bark, and fashion the bark into strong cord. By fastening to the cord a thorn from a honey locust tree, he created a useful fishhook similar to those used today on so-called trotlines. The entire procedure required about 30 minutes; White used only tools and materials that would have been available centuries ago in the natural environment, including a stone hand axe.

Another member of the experimental archaeology project is Greg Thomas, a flint-knapper; that is, he fashions articles from chert or flint with tools identical to those used over a thousand years ago. Thomas held the group spellbound as he transformed a large piece of local chert into a beautiful Snyder's point (a local type of projectile point which dates to between 200 B.C. and A.D. 400). His only tools were cobbles from a stream bed, pieces of deer and elk antlers, and cold-beaten copper. (Though copper is not native to the area, the Indians who made the Snyder's point had access to the metal by trading with residents of northern Michigan.)

Using traditional tools, Thomas is able to reproduce not just the shape of artifacts but even the flaking patterns characteristic of a particular style. His work has enabled archaeologists who specialize in the study of stone tools to better understand how they were orginally made and used.

The final stop of the field trip was at Cahokia Mounds State Park, a few miles east of St. Louis. The Cahokia Mounds, of which there were originally more than 100, have long been objects of wonderment to travellers. Today, unfortunately, most of the mounds are gone—victims of looting, bulldozing, and dynamiting by artifact-hunters and suburban land-developers; many of the remaining mounds have been defaced. All this has been done to what was possibly the largest "city" north of Mexico at A.D. 1000. Today, Cahokia's central portion, in-

*One of the larger round-top mounds at Cahokia Mounds State Park. Flat area in foreground is part of the plaza that extends south from Monk's Mound.*

cluding Monk's Mound—the largest of these structures, is owned by the state; much of the remainder of the site, however, is on private land and has no protection from vandalism or the encroachment of land-developers.

From the archaeological standpoint, the site is so extensive that it has taken many years for the complexity and importance of Cahokia to be fully recognized. Archaeological teams from the University of Illinois, University of Chicago, Washington University, Beloit College, and University of Wisconsin at Milwaukee have been active in coordinated research in the area. Rather recently, archaeologists discovered what is being called the American Woodhenge: a large circle defined by poles spaced at regular intervals. It has been suggested that this structure may have been used to chart the path of the sun in its annual cycle from north to south. It also appears that some of the mounds were precisely positioned and that they served as markers of periodic celestial events. In any case, some general pattern is evident in the Cahokia mound group, suggesting an advanced level of organization and planning. A tour of Monk's Mound, the plaza area in front, the reconstructed stockade, and the Woodhenge impressed tour members with the size, organization, and the amount of labor and energy needed to create the complex.

The Illinois archaeological field trip was an ambitious undertaking. Through site visits, nature hikes, native American craft demonstrations, slide lectures, and group discussions, nearly 10,000 years of prehistory and techniques of research from various field were compressed into five short days. This kind of crash course did not make an instant expert of anyone, but it is hoped that each participant came away with a deepened appreciation for archaeological research, and for the effort that is being made here in Illinois to preserve and understand part of the past.

*A Snyder's point made by Greg Thomas together with tools used to fashion it.*

# JUNGLE ISLANDS
# The "Illyria" in the South Seas

An account of the Crane Pacific Expedition of Field Museum, 1928-29

## Part II

Abridged from *Jungle Islands*, by Sidney N. Shurcliff. G. P. Putnam's Sons, New York (1930). Reproduced here, as abridged, by permission of the author.

*Part I of* Jungle Islands, *appearing in the July/August* Bulletin, *covered the first several months of the expedition. During this time the* Illyria *sailed from Boston to Bermuda, Haiti, Panama, Cocos Island, the Galapagos, and several other stops before reaching the New Hebrides, at which point we continue the account:*

Early the next morning the *Illyria* anchored in protected water off the small island of Wala and we arose to begin a day which turned out to be one of the most eventful of the whole trip. A glance at the shore was most encouraging, for instead of palm trees and tin roofs we saw a dense jungle almost crowding the white beach into the sea. Only a few low, thatched huts were hidden in the undergrowth. Better still, the beach was lined with outrigger canoes which had been drawn up above the high-tide level and already dark-skinned figures could be seen dragging some of them to the water.

Soon the *Illyria* was surrounded by friendly natives who paddled around and around her apparently very curious about this strange ship and its occupants. We were as much interested in their boats as they were in ours, for each canoe had a carved figure-head. Most of the figures were grotesque birds but a few other animals were represented. We also noticed the ingenious way in which the outriggers were joined.

Sketches by Walt Weber

Some of the natives could speak a little "bêche-la-mar," the South Sea equivalent for pidgin English, and of this we were soon given a sample. A man of more intelligent appearance than the rest looked up at me and asked, "Sip (ship) belong Vila?"

Having studied a treatise on pidgin English I was able to answer, "Sip he no belong Vila. Belong America!"

"Melica he stop long way?"

"Long, long way too much," I explained, "more long way Vila."

The native frowned thoughtfully for some time, apparently at the novel idea that anything could be further away than Vila. Then he smiled. "Vila more better," he said and paddled away in triumph.

Shortly afterward we went ashore in our small boat and scores of natives who came running at the unusual sound of our outboard motor helped us get our equipment ashore. But this feat once accomplished they became shy and constrained in their manner. A few women who had been lurking at the outskirts of the gathering took to their canoes and throwing some old rags over their heads and shoulders paddled away as fast as they could. Some small boys retreated to the jungle and three old men, naked, unless white hair and beards can be called clothing, glanced at us in hostile fashion and each produced from one of the beached canoes an old Snyder rifle loaded with antiquated but still dangerous cartridges.

The young men, however, continued to be friendly and invited us to visit the "place belong dance." As we were considering this offer a Catholic priest came walking along the beach. We were surprised to find him there, but he explained in French that he had been visiting a neighboring island and having seen our ship had paddled over to make a call. He said that the natives were very friendly except those of the generation of the three old men with the rifles. Their generation has never recovered from the bloody customs of cannibal days and such fierce feuds are still maintained between the different groups that they seldom dare to

venture abroad without their weapons.

The natives of Wala once lived across the strait on the mainland of Malekula but the hostility of the bushmen from the interior forced them to take to their canoes and seek safety on the island. Since no bushman dares to enter a canoe the inhabitants of Wala are safe from attack at home. However, the women must go across the strait into the danger zone every day in order to work in the gardens which are still maintained in the ancient clearings on the mainland. An armed escort always accompanies the women and thus a desultory guerilla warfare is carried on from year to year.

The Catholic Father explained that we need not be apprehensive as no white man has been molested on Wala for years. . . . He offered to show us the dance grounds himself. . . .

Imagine yourself tramping along an ancient trail through a dense tropical foliage so thick that there is only a half light. The quiet of the forest is unbroken by any sound from your barefooted guides but occasionally you hear a few sweet, liquid notes from the throat of an unseen bird that might well be a woodland spirit. On rounding a bend in the trail you look past the buttressed, creeper shrouded tree trunks in the foreground, into an immense natural cathedral. Its sides consist of the trunks of trees and its arched roof is symmetrically formed more than a hundred feet above you by their lower branches. At the further end is a gigantic cylinder of twisted roots and snarled vines—the trunk of a banyan tree. The many strands join into a single great bole some sixty feet above the ground and at a still greater height the branches spread out into an enormous canopy. From each branch hang vines and tendrils, like stalactites from the roof of a cave. The sheer beauty, the weird luxuriance, the sense of mysticism in the "devil-devil" glades of Wala exceeded anything we found in all the Pacific islands.

This marvelous setting occupies at first only the margin of your attention for something even more striking has caught your eye. Under the banyan tree are a multitude of grotesque tubular wooden forms with carved caricatures of faces, hollow eyes and long gray bodies—the devil-devils. They rise from the ground like toadstools, leaning at the crazy angles of futuristic skyscrapers. Of different heights and diameters they possess boundless individuality.

Some of these leering wooden giants are drums. They are made from a section of tree trunk partially hollowed out through a long slit in the front. When one is beaten with the fist it gives off a low note which echoes and reverberates through the aisles of the forest. If beaten harder with a stick the sound can be heard for miles, so the natives make use of the drums for signalling as well as for dance music. Many of the faces which have been so carefully carved have queer, human expressions, some of them positively humorous. They might be a gathering of hoary mountaineers. . . .

That evening we tried an experiment to which we had long looked forward. We gave the natives their first motion picture show. A screen was fastened on the boat-boom at right angles to the side of the ship and the electrically operated projector was placed on the gangway. By this arrangement

*Author-photographer Sidney Shurcliff with his cumbersome 35mm movie camera. His exciting 90-minute, six-reel film of the Crane Expedition will be shown at Field Museum on Saturday, September 29. (See coupon, p. 24).*

we could see the screen from the deck, while our audience also had a good view from their canoes in the water. They had promised "to come along sip when sun he go finish," but for half an hour after dark we saw not a sign of one. Finally the Captain gave a few blasts on his whistle and within five minutes our audience arrived. There were about thirty-five canoes from different islands, each loaded with men, women and children, and as the title of the picture flashed onto the screen they gasped with amazement.

The first scene, which showed an African native beating a drum, met with great approval. Then an audible murmur went over the audience as a group of natives was shown and when these began a war dance the excitement was terrific; our spectators gave vent to excited war whoops and made stabbing motions with their paddles. The excitement changed to disapprobation when a white man was seen in charge of the Africans. An aeroplane was viewed with complete indifference, but an automobile was considered highly amusing.

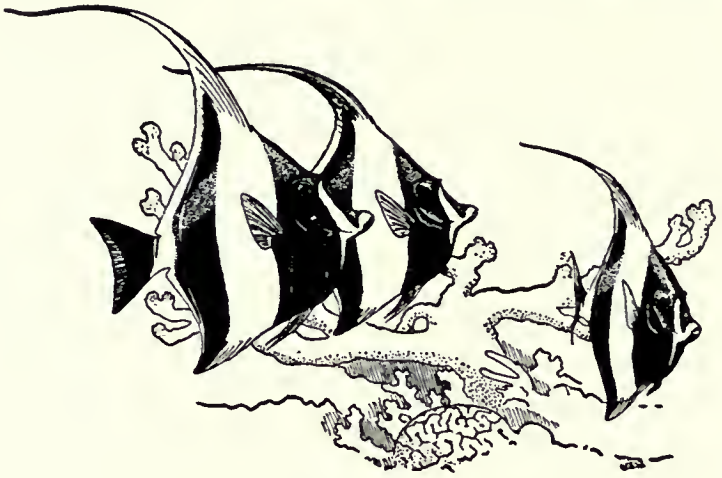
. . . Of course they could not understand the story at all but they were not surprised at the closeups and they seemed to grasp any representation of objects with which they were familiar. This was especially interesting because the reactions of the natives of New Guinea were in exact contrast when later they saw the same picture. They showed no interest in the automobile but were very excited by the aeroplane (perhaps because one had flown over them at some time). They were bored with the

African natives but burst into roars of laughter at a close-up of the heroine.

At one point the audience was nearly stampeded. Schmidty took a flashlight picture of them from the bridge, just above the screen, and by a queer coincidence he exploded the powder at exactly the same instant a man on the screen aimed a rifle at the audience. The brilliant flash momentarily blinded everyone and no doubt our audience thought they had been shot and killed for they were paralyzed with fright and did not utter a sound. Then, finding that everything was continuing as before, they concluded it was "something belong white man" and roared with laughter.

truly terrifying, and I had to remind myself that everything was all right. . . .

The climax of the evening had been reached for afterward there was only a repetition of the same drumming, singing and war whoops until finally it became very monotonous. When we turned on our lights to find who had been responsible for such a remarkable vocal output we saw a queer assortment of boys, young men and old men, about thirty in all. Although they sang in unison, their movements were anything but rhythmic. Apparently the population of Rano has become so depleted of late years that it is necessary to impress the entire male population for the chorus and, unlike small children, they are better heard than seen.



They watched five reels with close attention and at the close of the performance thanked us with an assortment of bloodcurdling war whoops.

After the picture show we went to the island of Rano about two miles away to see a dance for which Cornelius had arranged earlier in the day. We were met on the beach by a handful of natives who led us burdened with our heavy motion picture camera, flares, lights and other equipment for half a mile into the woods. Presently we came to a "devil-devil" glade and with our flashlights spotted the customary banyan tree and ten devil-devils. . . . We retired to a corner of the glade and waited in darkness complete except for the light of an old kerosene lantern. . . .

As if to fulfill my expectations a low rhythmical drumming reached our ears—apparently from the direction of the devil-devils—soft at first but increasing in volume. Then a faint weird sound of many human voices could be heard repeating in unison a few eerie notes. Cornelius said it sounded like the ancient Gregorian chant of the Roman Catholic Church. The sound, plainly at a great distance—almost as if in another world—grew louder and louder and then died away. After a short silence the drumming began again and as before the singing followed—but this time the singers had evidently come nearer. Again and again this performance was repeated and each time the singers closed in. When they had reached a point we judged not far away there came a sudden change in the technique. The gentle drumming and eerie singing was given as before but when we expected it to die away there came instead a series of hair-raising screams, not a hundred feet distant. The din was

When the dance was over we attempted to reward our hosts by presenting them with bead necklaces which we had selected long before at the ten-cent store at home. One more of our illusions of the South Seas was disrupted when the natives disdainfully refused the beads.

"He no good," growled the chief. "Me no like. Me want him feller whickey (whiskey). White master gammon along me too much altogether."

The dancers were so angry when they found we had brought none of their favorite beverage that if we had been a smaller party or if the event had occurred a score of years ago, I believe they would have attempted a reprisal. As it was such hostile looks were directed at us that we made a quick return to the beach and pushed off at once in our boats.

We reached the *Illyria* about midnight and went quickly to bed after a long day. . . . Walt had made several sketches and Schmidty had found four or five unusual lizards. For my part I had exposed in one day 830 feet of film and sixty still pictures as well as projecting the five-reel "thriller."

The following day we anchored off the island of Malo in the strait between that island and Espiritu Santo. On the shore was a large cocoanut plantation belonging to Mr. Wells, a hospitable and well educated Australian planter. Luckily for us, Mr. Adam, the District Officer for whom we were looking, was visiting Wells. . . . Wells said he could take us into the bush behind his plantation to see some of the more friendly bush natives.

Adam was less encouraging. "So you want to visit the Big Nambas tribe?" he said. "They're still cannibals and we can't trust them to behave.

Perhaps you are willing to take the chance. I'm not. So I can't give you permission."

His reason was that if we should get killed by the Big Nambas he would have to send to Australia for a battleship to punish the culprits. This very thing has happened several times and each time the blame for the heavy expenses incurred by the battleship has fallen upon the head of the local District Office. We tried to convince Adam that we were not anxious to commit suicide. He promised to think the matter over. . . .

Wells hit upon the happy plan of inviting all the bushmen and their wives to come down to his plantation the next morning so that we could photograph them with our heavy, more efficient cameras. At first the chief did not seem very enthusiastic about this plan, but by good luck I happened to have a cheap bracelet in my pocket and when this was presented to him and an offer made of a similar gift to every one who could come to the plantation he smiled and gave in. In fact he promised to bring not only several "big feller masters all same along me," but also "marys belong masters."

When we asked him what time he would come he pointed into the air at an angle of about forty degrees with the horizon and said, "Sun he stop."

"Good," said Wells, "that means eight o'clock. I expect there will be more bushmen at the plantation tomorrow than I have ever seen there at one time."

On the way back to the plantation one of our party inadvertently touched a stinging nettle. Within half an hour his hand began to swell and became very painful. As soon as we reached his house Wells treated the hand with ammonia. The pain at once decreased and the swelling soon disappeared. This incident reminded Wells of an event which occurred twenty years before, when he had first come from Australia and was the only white man on the island.

"I was just a kid then," he said. "I had never heard of these rotten nettles. One day, when I was helping the natives clear the land, I unwittingly chopped down a nettle bush.

"There was hell to pay. Within an hour my hands, face and whole body became terribly swollen. My skin formed into such tremendous blisters that I could neither see nor open my mouth. Yet I didn't know what had made me sick.

"I hung between life and death for three weeks, and was delirious most of the time. Several of the 'boys' were faithful—they gave me water and a little food. Then a trading schooner came to my harbor, and by purest chance a young medical student happened to be aboard. He brought me out of my terrible plight by bathing me with ordinary ammonia." . . .

Recruiting is one of the big problems of the British planters in the New Hebrides. The French are allowed to import Indonese laborers, but the English are required by their laws to find plantation hands within their own islands.

The difficulty lies in the fact that the natives are able to live perfectly happy lives without working at all. Hence, the plantation owners must offer them very attractive bait to make them "sign on" for work. The only alternative is to kidnap laborers.

Kidnapping has been so prevalent in the past that the wilder natives have become wary of recruiters and often fire upon boats which approach their harbors. At other times they ambush white men who dare to land on the beaches.

Certain planters who have built up reputations for honesty and square dealing with the natives have come to be trusted and respected. When they go recruiting they give away valuable presents to the chiefs. They pay well the "boys" who work for them and they return the boys to their homes when the working period (1 to 3 years) is over.

These honorable planters are usually successful in the long run. Nevertheless, even they take a certain risk when recruiting, for if some dishonest planter has recently kidnapped a native, his friends are apt to fire upon the next white man who approaches, whether he has a good reputation or not. Hence landings on strange islands are always made with two boats. One stays off shore with a crew of riflemen and covers the landing of the other. The landing party does not leave the beach for fear of ambush in the jungle. All business is transacted at the water's edge.

*Field Museum taxidermist Frank C. Wonder with young orangutan friend in Borneo, the final island to be visited by the Crane Expedition. Wonder (1903-1963) was on the Field Museum staff from 1926 to 1954.*

"But, accidents do happen," said Adam. "Two planters were killed and eaten last year. They had been careless. That's why I don't want you fellows to take any chances."

"Still, there is one place I might take you," he continued slowly. "It's an inland village of the Big Nambas tribe on Malekula Island. The natives there have recently shown signs of friendliness. They have allowed one missionary, Nicholson, to visit their village. He went only once, and was undoubtedly the first white man who has ever been there, but if we can get him to go with us I think we shall be safe. So if you are willing to fool around for two or three days while I get Nicholson, I will not only give you permission to go, but I will go along with you.

. . . It was decided that Cornelius, Dr. Moss, Murry and Chuck should be the lucky ones to go inland. Schmidty, Walt and Frank elected to be left at Hog Harbor, fifty miles away, to collect specimens while the Big Nambas expedition was under way.* We still had our date to keep with the bushmen, so we stayed at Wells's plantation overnight.

I had been very much impressed by the way in which Wells had told what time the natives would come by the angle at which the chief pointed into the sky. Now I began to lose faith in the method. The bushmen were supposed to come at eight in the morning, but it was not until eleven that the first one appeared.

After "plenty long time too much" seven more men straggled out of the underbrush. They were dressed in shells, bead money and ferns, and their faces were elaborately painted.

They understood nothing about the camera, but they regarded being photographed as a great honor. When we posed one man alone the others were so jealous that we could hardly keep them from crowding into the picture.

With the motion picture camera the difficulties were even greater. It seems that because they were chiefs four of the men felt entitled to stand directly in front of the other four at all times. We managed to get them to dance around in a circle, but the instant I began to grind the camera the four chiefs would stop and stand in a line in front of the others who, although they kept on dancing, could no longer be seen. Once one of the chiefs tried to stand in front of the other three, but they roughly pulled him back into line. Matters of etiquette are not taken lightly in the New Hebrides.

We were about to give up in despair when six "Marys" came down the trail from the jungle. They were very elaborately dressed for the great occasion in many strands of colored bead-money wound around their waists and hips. Their short curly hair was powdered with white lime dust and they were adorned with ear and nose ornaments. Aside from these decorations clothes were entirely absent. They were much more tractable about being photographed than the men, and we were able to get some interesting pictures.

*Karl P. Schmidt (1890-1957), herpetologist of international renown, served on the Field Museum staff from 1922 until 1955. He was chief curator of zoology at the time of his retirement. During the Crane Expedition he collected more than 2,000 reptile and amphibian specimens.*

*Expedition members mentioned here were expedition leader Cornelius Crane; Dr. William L. Moss of the Harvard Medical School; Murry N. Fairbank and Charles R. Peavy ("Chuck"), both Harvard classmates of Cornelius; Field Museum herpetologist Karl P. Schmidt; Walter Alois Weber, Field Museum illustrator; and Frank C. Wonder, Field Museum taxidermist.*

When the time came to give out the jewelry and trinkets we had promised as a reward, great confusion arose among the bushmen. The men insisted that they should all receive exactly the same kind of presents. But each woman wanted one more trinket than any of her rivals. There seemed to be no way to satisfy everyone until Wells, having the advantage of previous experience told us to close the jewelry box and to give each woman one piece whether she liked it or not.

Then he waved his hand and said, "Master he mad more! You feller Marys sing out too much, altogether! You feller Marys gammon along white feller marsters. Go! Altogether you go! Walk about! By'n bye you stop along house belong master. Master he catch 'em plarnty tobacco. Maybe you feller kill him talk-talk, master givem you piecee tobacco."

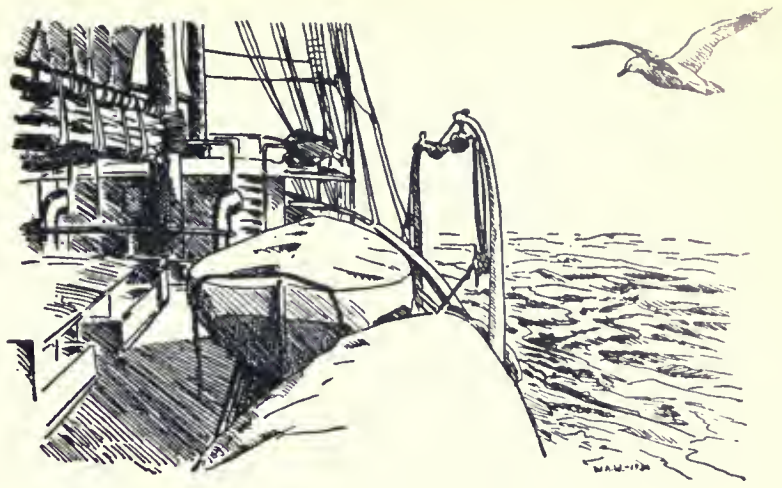
Upon hearing the word tobacco mentioned the bushmen and their wives smiled happily and soon departed in peace. We, also, bade goodbye to Adam and Wells and made a late start for Hog Harbor. But as the *Illyria* had to contend with a head wind and a strong adverse current we did not reach our destination until the next morning.

At Hog Harbor, on the island of Espiritu Santo, we found the largest cocoanut plantation and the most jovial planter in the New Hebrides. The plantation occupies a broad plain between the base of a long high cliff and the ocean. Nearly two hundred natives are constantly at work collecting the fallen cocoanuts and bringing them in Ford trucks to the drying sheds. From the nuts four tons of the juicy meat are extracted daily and this amount when dried makes two tons of copra. The latter sells at a price varying from $70 to $100 a ton, so it can readily be seen that the annual income from a plantation may be surprisingly large—especially if the manager, like Robertson, is clever enough to get his labor nearly free of charge.

To understand my last statement it is first necessary to know something about Robertson. He is a husky, hearty, deep-voiced Scotchman who has been through more adventures in each year of his life than has Nick Carter in several volumes. He ran away from Scotland at a very early age (though not so early as to interfere with the acquisition of an "A No. 1" Scotch accent) and fought all through the Boer War. Then he was for many years with the British army in India—stationed near the Khyber Pass. He went with Younghusband on his famous expedition to Lhasa—which in itself would have been enough of an adventure to last most people a lifetime. Robertson, however, fought all through the World War, first in the Gallipoli campaign and then in France.

Now he has "retired"; he merely handles two hundred unruly native "boys" and goes on recruiting expeditions for three months each year! He has grown so fond of his present life that he hates to leave his own domain. "I'm a bit of a despot here, you know," he said. "I'm 'Master Robie' and when I clap my hands things begin to happen! But when I go to Sydney I'm no better than any other man in the street and man! I'm scared to death of the traffic!"

But to get back to the cheap labor which "Master Robie" secures so plentifully and keeps so



cleverly. There is a trick in how he does it. The first part of his procedure is much like that of any other recruiter. Since the bushmen on his own island have plenty of food, pigs and wives, and since it is a serious crime to sell to them the rifles and ammunition which are the only things they desire, it is necessary for Robertson and his assistant to board their little yawl and search for recruits on other islands where the necessities of life are not so plentiful.

"I have to compete with all the other British planters," explained Robertson, "but I attack the problem in a different way. As an inducement to work they offer the Kanakas money—twenty pounds a year. But the Kanakas know from bitter experience that the money they receive at the end of their term of work will do them no good. They can't eat it. They can't buy wives with it. All they can use it for is to buy a cheap "bokkis," a chest filled with jewelry, mirrors and trinkets. Their three years of work are wasted.

"Now I use a little better psychology. Pigs are what the natives want—not money. A good pig can be swapped for a wife. On that point hinges my whole scheme.

"When I found that the boys prefer pigs to money I devised a scheme which leaves everyone satisfied. When I'm recruiting I go ashore, the same as the rest, with a second boat full of boys with rifles which stays just off shore, you know, to deal with any possible disturbance. I give a present to the chief and his young men and I say to him, "Maybe you feller Kanakas wantem Marys stop along house belong you." Usually at least one of them will say, "Yes, marster, me wantem Mary. Me no gotten pig." So then I say, "Maybe boy come stop along place belong me three years, me givem boy bokkis, me givem boy money and *me givem boy pig!*"

"Well, I have a fair reputation, y'know, and the boys believe me and they come and work for their three years. At the end of their time they go happy with the pigs and their 'bokkises,' and although I keep most of their wages they often come back to work for me again."

"Yes! Yes!" we said, "but where do you get the pigs? We were told that no planter could keep pigs because the bushmen steal them."

This was just the question "Master Robie" had been waiting for. He grinned broadly. "Well, man, you see it's like this—I've bought a little

island—nobody else knows just where it is—and I have three men there who do nothing but raise pigs. It's wonderful what you can do with pigs, my boy—it's mar-r-velous!"

While we were having a glass or two of beer with Robertson in his little unscreened summer-house we noticed several tall, pot-bellied natives wandering around the plantation with guns. Robertson explained that they were some of the friendly bush-natives from the interior of the island. The bushmen fight continually among themselves and prize their ancient rifles above every other possession. They are not allowed to buy more rifles or rifle ammunition, but each man owns one or two old brass cartridge cases and a bullet mold. In case of battle each native can fire only one or two shots and then has to run for home. There he unloads a shotgun shell or "Kartige belong pigeon," melts the shot to mold a rifle bullet, recaps his old cartridge case and reloads it with the powder from the shotgun shell.

"A bushmen never lets go of his rifle," said Robertson. "If there is a war dance he dances with his gun in one hand and when he sleeps he uses it for a pillow. Some of the younger generation who have no rifles must use a bow and arrows for their protection. An arrow is just about as dangerous as those old guns, for these fellows are not good marksmen, but a rifle is necessary to the prestige of an older man. Many a bushman has been murdered for his gun. In fact a man died only last night from poison put in his food because of a dispute over an old Snyder rifle. . . ."

Schmidty, Walt and Frank found Hog Harbor an ideal place for collecting. Robertson gave them each a bed in his house and a room in which to work. He also detailed three of his best plantation boys to guide them along the jungle trails and to help with the collecting and the skinning of specimens.

Working conditions were ideal and bird and insect life was plentiful. Frank succeeded in getting some very unusual bats from a cave on the mountain side. Schmidty found a new variety of scorpion under the bark of a teak tree. Walt made a large collection of brilliantly colored little birds, and also shot some parrots, the first we had seen. He continued work on his paintings and made several pen and ink sketches.

By the time we were to return to Wells's plantation to start the Big Nambas expedition they had transformed Robertson's whole house into a scientific camp. Thus we felt no hesitation in leaving them for several days because there seemed to be plenty of interesting work for them to do. We found Adam and Nicholson [the missionary] waiting for us. . . .

"I have asked Wells to come with us, too," he said. "I think it will be an advantage to have three experienced men on this trip."

At dawn we left Wells's plantation for the Northwest coast of Malekula island—the heart of the Big Nambas territory. . . . The coast was steep, mountainous and thickly wooded. We could find no anchorage except in a small open bight at the foot of the trail to the Big Nambas villages. The captain thought it a very poor anchorage, for the ocean swell swept in upon us, making the yacht roll badly. However, there was no alternative. He had to make the best of it.

"Now to tell the natives that we are here!" said Wells. "Give me two sticks of dynamite to explode in the water. That is the regular recruiter's signal for a 'talk talk.'"

He lashed each stick of dynamite to a small piece of wood and inserted fuses. Then he wet his finger and carefully tested the direction of the wind.

"Always throw the dynamite to leeward," he explained. "A few years ago a careless friend of mine tossed a stick overboard without looking which way he threw it. The wind and current brought it back to his ship, where it exploded. The whole stern was blown away; two natives were killed and my friend was seriously injured."

Lighting the fuses, Wells threw the two packets overboard. A few seconds later they exploded with a tremendous roar, which reverberated like thunder along the shores and against the cliff.

We waited for half an hour, but no answering shouts or any signs of response could be detected.

"I guess there is no one near the shore," said Nicholson at last. "We shall have to send our two plantation boys up to the village to confer with the chief. They can speak the Big Nambas dialect, and perhaps they can persuade the chief to come to the shore." . . .

They returned to the shore a little after midnight and signalled with a flashlight for the launch. Once on board they delivered a message from the chief.

"Big feller marster he say he come along beach along zip (ship) same time sun he commence. Byme by white marster maybe go along place belong big feller marster."

We all got up before daylight the next morning and at the first gleam of dawn we saw five black figures dimly outlined against the gray beach. Nicholson was very excited.

"They have come," he said. "I will go ashore alone to talk to them. A ship was fired upon here recently and if too many of us go ashore at once they will think we are a punitive expedition. Don't worry, I shall be perfectly safe."

Savages have no sense of the value of time. Hours are often required to make a single decision. In this case Nicholson had to talk to the chief for nearly an hour to persuade him to come out to the ship. The chief and one of his counsellors finally got up courage to come on board, but the other three were afraid they might be kidnapped. The chief's reputation for bravery was probably increased a

hundred fold by his short visit to the *Illyria*.

Maloon was the name Nicholson gave the chief. He was about 5 feet 8 inches tall and fairly well formed. His broad face was set with intelligent eyes and a thick nose. He wore several bamboo combs in his frizzly reddish hair and a thick wooden belt around his waist.

Maloon's counsellor was older, more pot-bellied and less intelligent in appreance. Nearly all the time he was on board the *Illyria* he wore an expression of dazed bewilderment which amounted almost to a stupor. He took no interest in what was going on.

Maloon, by the way of contrast, seemed eager to understand what was around him. He had brought a gift of yams rolled in tobacco leaves for "man belong zip" and one of his first acts was to present it to Cornelius. We gave him a ham sandwich in return. He gobbled it up at a tremendous rate.

Maloon was overcome by the height of the masts. Every few minutes he would lean back to gaze up at them. His piercing glance seemed to take in everything above decks and within a few minutes he lost all signs of fear. He attempted to touch everything that interested him. Apparently he was accustomed to use his sense of touch almost as much as his sense of sight in comprehending a strange object.

After a short while we took Maloon into the engine room. He was so amazed by the tangle of pipes and machinery that for a few moments he was quite as bewildered as his counsellor. This change from the simple things to which he was generally accustomed seemed to terrify him.

Cornelius gave him a small flashlight and showed him how to operate it. This was one thing the chief could understand. He switched it on and off with exclamations of delight and took it up on deck to show his counsellor. On the way up he passed in front of an electric fan which happened to be running full blast. As the cool air touched his bare skin he jumped back as if he had been shot. Then he turned and looked very closely at the fan. I thought he was going to thrust his hand into the blades, but instead he merely pointed at it and laughed very loudly.

Nicholson talked to Maloon for a long time and finally secured his consent to an inland trip by the white men.

"All right," said Nicholson, turning to Cornelius, "seven of us can go up to the village. The chief will lead the way, and he promises to protect us."

"However," he added, "no one can take any firearms because the Big Nambas are short of weapons and if they saw guns within their grasp they might not be able to resist killing us to get them."

Dr. Moss, Cornelius, Chuck and Murry were chosen to go with Adam, Wells, and Nicholson. They were taken ashore in the small boat with the chief and his aide. There the three other natives who had been waiting joined them. Burdens of food and cameras were apportioned to everyone but the chief. From the ship we saw them all string out into a long procession headed by Maloon. He led them along the beach a little way and then, parting the bushes, disclosed the mouth of a tunnel-like trail in to the underbrush. One by one our friends entered the tunnel and were lost to our sight. The jungle seemed to have swallowed them up.

I now quote from Cornelius an account of the journey to the village—

"Hardly had we left the beach than a steep wooded cliff 200 feet high rose before us. This was the beginning of a terrible eight mile climb through the tropical forest.

"The country is composed of steep knife-edge ridges three or four hundred feet high, rising one behind the other to mountains in the center of the island. The trails are built along the ridges wherever possible so that enemies can be seen approaching at a distance. However, the natives do not hesitate to make their paths branch into ravines whenever it seems convenient. We followed the dry bed of a stream for a while and then crossed more heights. As we rose in altitude the ground became wetter and the district more thickly wooded.

"The tall grass was an ideal place for an ambush, as men standing within an arm's length of the trail would have been completely hidden. We were not at all reassured by Wells' story of how a punitive expedition of French and British Marines had been forced back almost dead with exhaustion and with many men wounded, having narrowly escaped being entirely cut to pieces.

"The chief, however, had been trying to make up for the bad reputation of his tribe by being as helpful and as agreeable as possible. He cut staffs for us to use in climbing the steep trail and several times helped us over exceptionally bad spots. Nicholson also pointed out that these bushmen were carrying no firearms, which was very unusual.

"Finally, after struggling along until nearly mid-day, we reached the village. At the first sign of our approach all the women and girls had fled, uttering screams, perhaps more coquettish than frightened. A few small boys remained in sight and we saw some bearded men peering out of the woods.

"Maloon called to his people to return. Soon a few men straggled into the clearing, but the women would not come back. The village consisted of a number of thatched houses, such as we had seen at Wala, but they were higher and of better construction. One was a club-house, but try as we would Maloon would not allow us to enter. Through the doorway we could see human skulls hanging inside.

"The natives were so excited and ran about so fast that we could not take pictures of them. Perhaps this was just as well, for they were afraid of the cameras and might have become angry had we insisted on using them.

"More and more men straggled into the village until we were surrounded by at least thirty of them. Some squatted down on their haunches and gazed at us steadily for minutes at a time. Others were more inquisitive. They had never seen white men at close range before and were not satisfied merely to see us, but insisted on feeling of us. They squeezed our arms and legs and rubbed our stomachs. It was not a pleasant sensation, for they were ugly and greasy and we knew they were cannibals. However, Nicholson and Adam had warned us we might be handled and had told us that if we took it amiably the Big Nambas would consider it a sign of friendship. . . .

*Sidney N. Shurcliff, author of the account reproduced here and the expedition's official photographer, is today a landscape architect. Inquiries about the expedition may be directed to him at 2 Central Square, Cambridge, MA 02139.*

"Presently the savage throng began to hem us in entirely too much for our satisfaction. They bumped against us and uttered unfriendly grunts. to relieve the situation Nicholson asked Maloon to lead us to the devil-devils. When he did so the cannibals followed, but we kept moving about so that they could not surround us. The devil-devils were about the same as those we had seen at Wala.

"When the savages tried to hem us in again we went back to the village and sitting down with our backs to the wall of a hut, opened our lunch bags and began to eat. We motioned the natives to keep away to give us room to spread out our supplies.

"Suddenly a great savage-looking fellow came up to one of our lunch baskets and ripping it open, began taking things out. Without any hesitation Adam jumped up, pushed the man roughly away and reprimanded him sharply. We were frightened, for we feared the Big Nambas would resent such rough treatment of one of their warriors. However, Adam assured us he had done the right thing.

"'That fellow was deliberately trying to steal our lunch and he knew he shouldn't,' he explained. 'If I had let him get away with it he would have immediately done something worse and soon the whole pack would have been on us. You must use child psychology with these natives—nip any mischievous act in the bud or you will get into serious trouble.

"Adam seemed to have the right idea. The natives backed away slowly and squatted down on the ground all around us without showing any signs of anger. They were ugly looking fellows, but we seemed to be masters of the situation.

"While we were eating Nicholson had a long talk with Maloon.

"'I asked the chief whether we could go any further inland,' said the missionary, 'but he refuses. He says that this village is now at war with the next one, which is only a few miles further up the mountain side. Although there is a lull in the fighting today, several men have been killed during the last week. The chief expects an attack on this village this afternoon or evening, for his scouts have reported that the enemy are gathering. Consequently he advises us to return to the shore as quickly as possible so as to avoid any chance of danger. I think we have seen nearly everything of interest here. We may as well follow his advice while we are able to do so.'

"Well," concluded Cornelius, "That is about all there is to tell. We distributed the presents of tobacco which we had brought and gave the chief one or two special gifts. The natives did not attempt to impede our progress on the return trip, though they could easily have done so, and so after walking the eight miles again we arrived safely back at the beach. Our trip to visit the cannibals had been as successful as we had hoped, though not as exciting or dangerous as we had anticipated."

That evening we weighed anchor and sailed away toward Hog Harbor to pick up the scientists and deposit our guests before heading for the Solomon Islands.

*After the Solomons, the* Illyria's *itinerary included New Britain, New Guinea, and Borneo. At this point, the expedition members left the ship and returned to the United States by other means, arriving home nearly 11 months after the outset of the expedition. The* Illyria *continued westward with its crew and arrived in Boston harbor on Oct. 16, 1929.*

*Specimens collected during the expedition included 12,000 fishes, more than 2,000 reptiles and amphibians, 1,200 birds, 881 mammals, and more than 2,000 invertebrates. The film shot by Sidney Shurcliff—a 90-minute account of the adventure—will be publicly shown for the first time in many years at Field Museum on Saturday, Sept. 29, in James Simpson Theatre. Tickets for this showing may be ordered by sending in the coupon below (or facsimile).*

**"JUNGLE ISLANDS"**
1928-29 Crane Expedition Film
Saturday, Sept. 29, 2:30 p.m.
James Simpson Theatre
Introduction and commentary by
Dr. Robert F. Inger, curator of
amphibians and reptiles

For tickets please send coupon (or facsimile) to:

PROGRAMS: Education Dept.
Field Museum of Natural History
Roosevelt Rd. at Lake Shore Dr.
Chicago, Ill. 60605

Please send me _____ number Members' tickets for film showing ($2.00 ea.)

_____ number Nonmembers' tickets for film showing ($3.50 ea.)

_____ number Members' tickets for 12:30 buffet luncheon preceding film showing ($3.00 ea.)

Amount of check enclosed $_____

Tickets will be mailed upon receipt of check.

Please include self-addressed, stamped envelope for the return of your tickets.

last name _____ first name _____

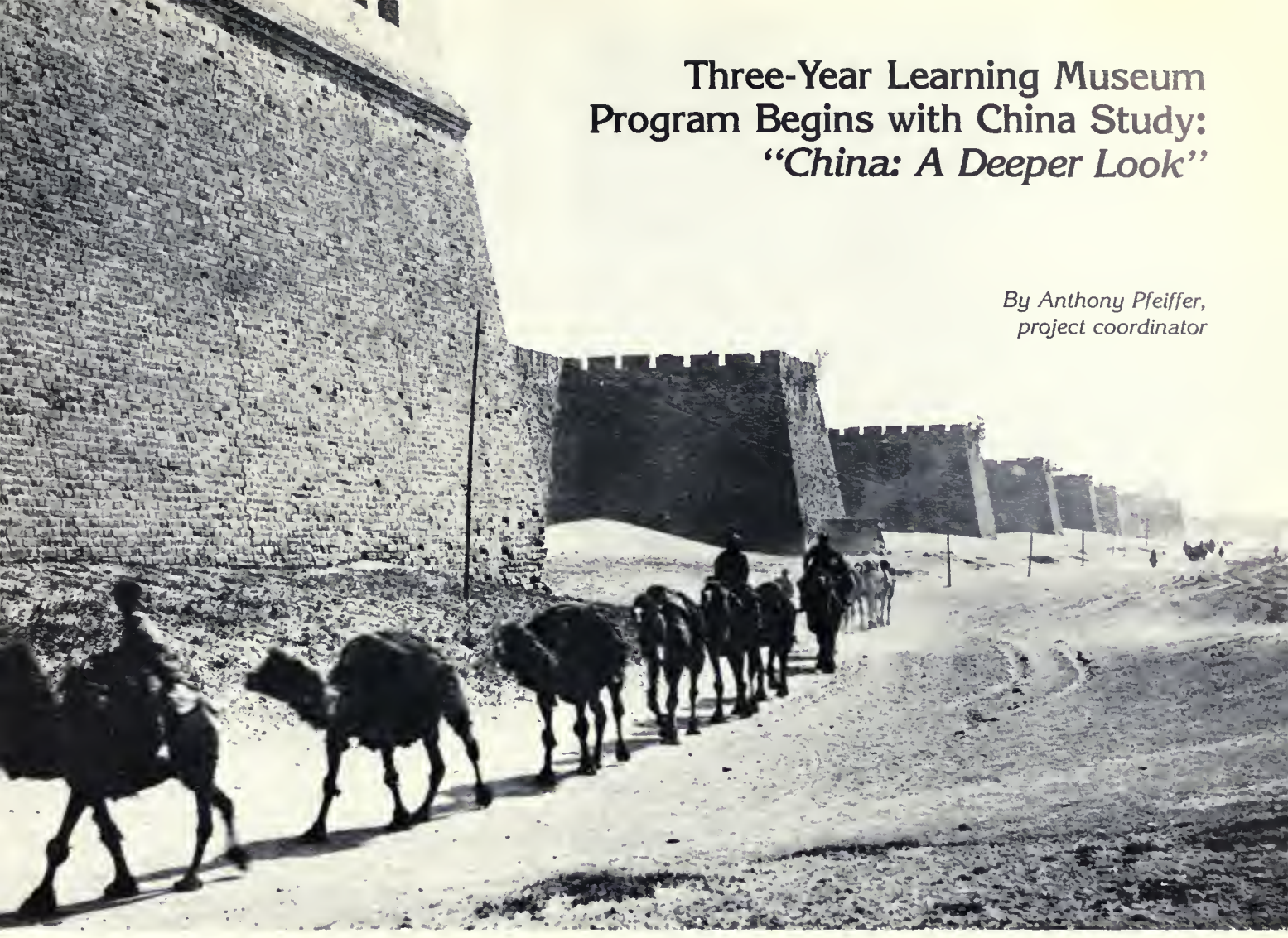
street _____

city _____ state _____ zip _____

daytime phone _____ evening phone _____

# Three-Year Learning Museum Program Begins with China Study: *"China: A Deeper Look"*

*By Anthony Pfeiffer, project coordinator*



*The expeditions to China and Tibet of Berthold Laufer, curator of Asian ethnology 1908-34, secured for the Museum many of its finest art pieces as well as a great variety of utilitarian items reflecting the nature of daily life.*

CHINA: what images does the name evoke? Initially you may think of an immense, forbidding land or simply of chopsticks and exquisite food. But when you dwell on it a bit more, wildly contrasting views come to mind. On one hand, you may imagine a Manchu warrior, schooled in the martial arts, sinister and hard. On the other hand, you may envision a mystically haunting painting, drawn with few elegant lines, soft and delicate.

For centuries the West has alternately admired, denigrated, or ignored China. For decades the United States, the world's richest nation, has not formally recognized the People's Republic of China, the world's most populous nation. Now, as we enter a new era of governmental, cultural, and economic relations with the People's Republic, we need to know more about its land and culture.

Field Museum announces "CHINA: A DEEPER LOOK," the first in a series of courses of study made possible by a grant from the National Endowment for the Humanities (NEH), a federal agency. The Field Museum of Natural History has been designated an *NEH Learning Museum*. CHINA: A DEEPER LOOK offers the opportunity to explore China's enduring culture, delving into its origins and tracing its development through time.

Field Museum's first *Learning Museum* course of study is an historical examination of the multifaceted Chinese culture. Some of its elements, such as the writing system, date back five thousand years. It is virtually impossible to understand today's China without an understanding of China past.

Ron Testa

*Bennet Bronson, associate curator of Asian archaeology and ethnology, served as consultant and resource facilitator for "China: A Deeper Look."*

Before China was "lost" to the United States, two Field Museum collecting expeditions were successfully launched. The Mrs. T. B. Blackstone Expedition, 1908-10, was led by Berthold Laufer, then assistant curator of Asian ethnology at Field Museum by special appointment. Laufer's time in China and Tibet was fraught with physical hardships, the intransigence of local officials, thievery, and even dog bite. As leader of the Captain Marshall Field Expedition in 1923, Laufer was kept out of the interior of China by warfare and banditry. Despite all difficulties, he collected many representative pieces, as opposed to art for art's sake.

Field Museum's Chinese artifacts reflect the full range of historical periods and can show a great deal about how people lived in each cultural era. For these purposes, they are among the best in the country. CHINA: A DEEPER LOOK unites the China collections at Field Museum with an accomplished faculty. Films, annotated references, access to a library of select materials, written guides to collections, and a cultural performance are further combined to give a colorful and substantive view of what Laufer called "the most marvelous civilization on earth."

CHINA: A DEEPER LOOK has been planned in conjunction with two subject matter specialists. One of these, Bennet Bronson, is associate curator of Asian archaeology and ethnology at Field Museum, the position that began with Berthold Laufer. A large portion of Field Museum's China holdings is not on display. That portion is inaccessible without Dr. Bronson, not only in the sense that he has the keys to the special storage areas, but because he knows what's there and how it can be used. Through Bronson, both exhibit and "behind the scenes" artifacts are utilized as material glimpses of the roots of Chinese culture.

*The Great Wall of China effectively symbolizes the agelessness of Chinese culture.*

**NEH Learning Museum**

*The NEH Learning Museum program is a three-year sequence of learning opportunities centered around the Museum's outstanding exhibits and collections and designed to give participants an opportunity to explore a subject in depth. Each unit of study consists of one or more special events, a lecture course, and a seminar for advanced work. Special events are lectures by renowned authorities or interpretive performances and demonstrations. Course members receive an annotated bibliography, a guide to pertinent museum exhibits, study notes for related special events, and access to select materials from Field Museum's excellent research library. In-depth, small-group seminars allow more direct contact with faculty and Museum collections.*

Professor Ping-ti Ho, also consultant to our China project, is a distinguished historian and sinologist who has been based at the University of Chicago for sixteen years. *Studies in the Population of China, 1368-1953* was his first major work. *The Ladder of Success in Imperial China, 1368-1911* and *The Cradle of the East: An Inquiry into the Indigenous Origins of Techniques and Ideas of Neolithic and Early Historic China, 5,000-1,000 B.C.* are also among his many published works. Professor Ho has been a leader in the movement to broaden the scope of modern research in Chinese history. He never lost touch with his native land, having been to 16 of 18 provinces of China proper, Chinese Turkestan, and Manchuria. On October 10 he shares this geographic knowledge with us and introduces his students who teach the CHINA: A DEEPER LOOK lecture course.

CHINA: A DEEPER LOOK begins October 5 with a keynote address by Jonathan D. Spence, noted historian of China and professor of history at Yale University. Although Marco Polo may have "discovered" China in 1275, it wasn't until after 1600, when Jesuit missionaries settled in Peking, that the West began to get detailed reports on Chinese life. Dr. Spence takes us through four centuries of tangled Western feelings toward China, its history and literature, its governmental structure, and its demographic problems. This overview pinpoints areas of Western understanding and misunderstanding of China. Some of the misconceptions are unfortunately as prevalent today as when they originated centuries ago.

After Dr. Spence's broad perspective on studying China, you are invited to join a lecture course which begins by looking at the diversity of China's land, plunges back into prehistory, and traces the development of Chinese civilization. Seven thousand years ago the agricultural base for Chinese civilization was established in the North China Plain. While prolific crop growths supported some of the world's first villages, the Yellow River periodically flooded and, over the millenia, took literally millions of lives. A remarkable pageant of peasants and emperors unfolds as major historical periods are reviewed, all illustrated with artifacts from Field Museum collections.

The course leads up to the Ch'ing dynasty in the early nineteenth century. Themes followed throughout the course lend coherence to what might otherwise be a bewildering succession of people, places, things, and bygone times. The whole of China's history is seen as a dynamic procession of dynasties, each having to deal with population pressures, changing routes to social mobility, and the tendency to split apart into warring

Sam Wilkins

*Jonathan D. Spence, famed authority on Chinese history and culture, gives "China: A Deeper Look" keynote address on Friday, October 5.*

*Anthony Pfeiffer, project coordinator of the NEH Learning Museum Program, shown while researching chimpanzee behavior for his recently completed doctoral work in anthropology at Rutgers University.*

segments; and each one inheriting a tradition of philosophy and cultural accomplishment rivaled only by its own achievements.

A sampling of the cultural life of China is skillfully presented in "Aspects of Peking Opera" on Friday, October 19. Derived from historical events and classical novels and originating between the eighth and tenth centuries, traditional opera selections are performed by Hu Hung-yen, accompanied by two musicians. Her repertoire includes "Picking up the Jade Bracelet," depicting a flirtation between a coy maiden and a young nobleman, and "The Spear Dance," showing a woman using acrobatic skills to defeat her male enemy.

To bring looking at China up-to-date, course participants are given the chance to follow the legacy of China past into the development of China today. Some historical highlights include the turmoil and fall of the Ch'ing Dynasty, the exploitation of China by Western and Japanese powers, and the emergence of the People's Republic of China. When the Ch'ing Dynasty fell in 1912, a sentimentalist commented: "The glory of Spring has gone and does not return." But has the glory gone? Compared to Imperial China, has the peasant's lot in life improved in the last half century? How has village and family life changed? What about folk culture and religion? And what kind of new elite has emerged and how did they get to the top? How do they dispense justice and exert social control? The seminar deals with questions such as these.

In short, Field Museum is mobilizing its considerable resources and those of an excellent faculty for a fresh and timely look at China. CHINA: A DEEPER LOOK should be of interest to the traveller, the business person, and to anyone wanting the background to an historic new era. Chicago-area members will receive a special mailing of program details and registration materials. For further information please write NEH Learning Museum Program, Department of Education, Field Museum, Roosevelt Road at Lake Shore Drive, Chicago, Il., 60605 or phone 922-9410, ext. 395.

*Hu Hung-yen, the only professional actress of Peking opera now resident in the United States, will perform in James Simpson Theatre on Friday, October 19.*

*Vintage scene of Chinese shopworkers, ca. 1910.*

# BOOKS

CLIMBER'S GUIDE TO DEVIL'S LAKE, *by William Widule and Sven Olof Swartling.* University of Wisconsin Press; 198 pp., 44 illus., $8.95.

To be a mountain-climbing enthusiast in the Chicago region would seem as frustrating as being an avid yacht racer in Afghanistan. There is, nevertheless, a very active and energetic Chicago Mountaineering Club, whose meetings are held regularly at Field Museum. Although it's thousands of miles to a legitimate mountain, climbers in this region keep up their skills, and learn new techniques, by scaling the many faces of the steep quartzite cliffs that rise over 400 feet (122 meters) above Devil's Lake, Wisconsin.

This guide book is the result of many years of climbing in the Devil's Lake State Park by two members of this club. In it they give details of hundreds of climbs, how to find the starting places, any particularly tricky points, hazards, alternate ways, and ultimately routes to the top. It is the most comprehensive guide available to this excellent climbing area, designed to serve novices and pros alike. The guide is amply illustrated with 44 diagrams, drawings, and photographs. There is an excellent introduction to the geology, natural history, and hiking trails of the area by Pat Armstrong (a staff member of the Morton Arboretum).

The guide is highly recommended both for climbers who are newcomers to the midwest as well as old hands to Devil's Lake. Even if you're not a climber, it is a good hiking guide to the trails of the area. Measuring 10.1 cm X 15.2 cm X 1.3 cm, and weighing a mere 235 grams, the book is just the right size to tuck into your breast pocket. When you're hanging on a line, the piton is slowly pulling out, the rope fraying before your eyes, and there are jagged "teeth" of quartzite pointing up at you, far below, it's nice to know you can pop this guide out of your shirt pocket and quickly look up an alternate route!—*Edward Olsen, curator of mineralogy.*

KOSTER: AMERICANS IN SEARCH OF THEIR PREHISTORIC PAST, *by Stuart Struever and Felicia A. Holton.* Anchor Press/Doubleday; 281 pp., $12.95.

This book is about the archaeologists and the archaeology of one of the most comprehensive and innovative research programs in this discipline in the United States. Archaeologists generally write for their peers, using the technical jargon and format which either fails to discuss methods used to recover information or does so in language familiar only to specialists. Because of the corresponding absence of general literature on North American archaeology, many Americans are unaware that sites containing remains of prehistoric cultures abound within each of the 50 states. Struever and Holton make it a point to apprise the reader of the wealth of sites in America, though their discussion concentrates on the Lower Illinois Valley, where over 1,000 sites have been located and recorded.

Theirs is not a book about a single site in the Lower Illinois Valley nor is it simply about a single man's (Stuart Struever's) research. It is a fascinating account of a major research project, one which integrates the individuals and personal experiences with the actual fieldwork, analyses, and interpretations. The authors explain what archaeologists do and how they reconstruct now extinct human cultures. Therefore, while some of Struever's trips into nostalgia may seem distracting to another archaeologist, he successfully conveys how an archaeologist feels about his work, what he sees and thinks—what it is like to be an archaeologist. His feelings and personal insights convey experiences that are common to many archaeologists, though seldom expressed.

Although *Koster* is mainly an account of Struever's research in the Lower Illinois Valley, it also integrates the findings at Koster into a broader framework—that of the cultural development of prehistoric man in the New World. *Koster* is fitted into this general framework when, for example, information from Koster is used to demonstrate that Amerindians began living in settled, year-round communities by 3000 B.C., while still subsisting by hunting and by the gathering of wild plants. Later occupations at Koster demonstrate increasing stability, growth, and social complexity which accompanied the adoption of agriculture.

Struever and Holton are most successful when describing techniques for recording the archaeological finds and for deriving cultural and environmental reconstructions from what a layman would view as no more than a jumble of artifacts. Some of these techniques were pioneered at Koster; for example, the separation of minute plant and bone materials from the encompassing soil by "floating" them out in water. The Lower Illinois Valley archaeologists also adopted existing analytical techniques and applied them to problems at Koster. For example, by examining lithic debris and the wear and breakage patterns on stone tools, researcher Thomas Cook has been able to distinguish areas where animals were butchered from localities where animals were cooked.

While definitely not a "how to do archaeology" book, *Koster* does convey how a great deal of information can be deduced by trained individuals from an archaeological site. Struever also demonstrates the valuable contributions nonprofessionals have made to the Lower Illinois Valley program. They have done this by cooperating with and providing information on site locations to archaeologists; the latter are then better equipped to build models of prehistoric activities and long-term development. While emphasizing the importance of the layman's role in archaeology, it is apparent that only through the efforts of many trained individuals has it been possible to reconstruct the activities and long-term events participated in by the prehistoric inhabitants of Koster. —*Patricia S. Essenpreis, Department of Anthropology, Loyola University of Chicago.*

# Weekend Discovery Programs

On Saturdays and Sundays, discover Field Museum's wealth of natural history resources via films, gallery tours, demonstrations, and slide presentations. The activities listed below are highlights only, of Weekend Discovery Programs. A complete listing of activities for the day is available at Museum entrances.

Sunday, Sept. 9; 1:30 p.m.: *Indian Fishermen of the Northwest Coast* is a 45-minute tour illustrating fishing methods as well as the importance of the fish in story and song. These coastal people rely upon the fish harvest as a primary food source and for personal wealth and prestige.

Saturday, Sept. 15; 11:30 a.m. *Early Man* is a half-hour tour that traces major trends in the physical and cultural evolution of man.

1:30 p.m.: *Film Features—African Wilderness* as depicted in the film "Mzima: Portrait of a Spring." The hippopotamus is the central character in this examination of African wildlife.

**September Discovery Highlights**

Saturday, Sept. 8; 11:30 a.m. *Ancient Egypt* is a 45-minute tour that explores the traditions of ancient Egypt, from everyday life to myths and mummies.

1:30 p.m.: *Film Features—African Wilderness* as depicted in film "Baobab." The giant African tree, the baobab, is portrayed in this film as the home and sustainer of innumerable insects, reptiles, birds, and mammals. It provides a miniature world where many species mutually support each other and where protection and survival are provided.

Its survival ensures the existence of other species at the spring, such as crocodiles, elephants, impalas, zebras, baboons, monkeys, kingfishers, spiders, fish, and frogs.

Sunday, Sept. 16; 12 noon: *Life in Peru* is a half-hour slide presentation of life in ancient Peru and its ties with modern Peru, as interpreted through its pre-Inca pottery.

Saturday, Sept. 22; 11:30 a.m. *Introduction to Hopi Culture* is a half-hour tour that focuses on the rich heritage

of Hopi religion, its iconography and traditions.

12:30-2:00 p.m. *Ancient Art of Spinning* is a demonstration of spinning along with information on its history and development in several cultures.

1:30 p.m. *Film Features—African Wilderness* as depicted in the film "Kenya-Uganda Safari." The camera ranges over the varied landscape of the Kenya-Uganda area of East Africa, filming its great variety of wildlife.

Sunday, Sept. 23; 1:00 p.m. *Endangered Animals* is a half-hour tour focusing on animals that are in danger of extinction.

Saturday, Sept. 29; 1:30 p.m. *China through the Ages* is a look at traditional China: its inventions, court life, and schools of thought. Rare slides taken from turn-of-the-century lantern slides collected by Berthold Laufer, curator of Asian anthropology from 1907 to 1934 will be featured.

Sunday, Sept. 30; 2:00 p.m. *Indians of North America* is a tour that explores the life of six tribes, from the Iroquois in the North to the Hopi in the Southwest.

**October Discovery Highlights**

Saturday, Oct. 6; 12 noon. *"In the Land of War Canoes,"* Edward Curtis's classic 1914 film drama captures the life and spirit of British Columbia's Kwakiutl Indians; 45-minute program also includes slides of Curtis's still photos of Northwest Coast Indians.

1:00 p.m. *Endangered Animals* is half-hour program focusing on animals that are in danger of extinction.

Sunday, Oct. 7; 1:30 p.m. *Indian Fishermen of the Northwest Coast* is a 45-minute tour illustrating fishing methods as well as the importance of the fish in story and song. These coastal people rely upon the fish harvest as a primary food source and for personal wealth and prestige.

Saturday, Oct. 13; 11:00 a.m. *American Indian Dress* is half-hour tour that explores the construction, craft, style, and symbolism of Indian dress from six regions of North America, from the northern woodlands to the Southwest.

1:00 p.m. *Film Features—Arts in Native America* as depicted in 50-minute film "The Crooked Beak of Heaven," which views the Kwakiutl and other tribes of the Northwest Coast. Focuses on their long winter dramas, totem poles, and potlatch ceremonies.

Sunday, Oct. 14; 12:30 p.m. *Culture and History of Ancient Egypt*. An orientation film precedes this 45-minute tour of the Museum's collection of ancient Egyptian artifacts; tour concludes with explanation of mummification process.

### Midwest "in the Soup": Hazy Blobs Abound

Let's take a little cross-country trip, via satellite.

Our guide is Walt Lyons, a Chicago TV weatherman, who also happens to be a leading expert on air pollution transport.

"Have you ever noticed that the summertime skies aren't as blue as they used to be?" he asks.

"Studies done at Washington University over the last few years have looked at national weather service visibility reports for the past 50 years. What's been discovered is that visibility in rural areas has progressively worsened, with visibility running only three or four miles in the middle of the afternoon, with brown hazy skies, rather than blue skies.

"From May to October, we have these high pressure systems that come down from Canada with 25 to 30 miles of visibility. They move into midwestern U.S. and sit there. They might just hang around for two or three weeks. The air in this system just makes big lazy clockwise circles hundreds of miles wide," he goes on.

"Emissions from large coal-fired power plants in the Ohio River valley, for example, drift lazily along with this flow, with the sun beginning to 'bake' these emissions. What was initially colorless gas is now being converted by the sun into minute particles, including small specks of sulfuric acid.

"So, if you consider the dozens of power plants, especially in the Ohio River valley, pumping tons of pollutants into this essentially nonmoving air mass over the midwestern United States for weeks at a time, that's where the haze is coming from."

This soup is not just made up of sulfate particles, but also of emissions from automobiles—ozone.

Lyons' theory, based on a study of thousands of satellite photos, posits that the hazy blob formed in the Ohio valley turns in a clockwise direction to the north bringing hazy days to Illinois, Iowa, and Minnesota—then turns towards the Great Lakes and up through Canada, then down through New England and out into the ocean.

"We've seen this plume 1,500 miles out into the Atlantic Ocean, and who knows, it may end up in Europe," he speculates further.

Lyons is convinced that the best way to see this process at work is not by running ground studies, but by looking at real-time satellite pictures that have been "processed" through a sophisticated computer system and can clearly show pollutant transport.

These high pollution readings—up to 160 parts per billion—are not necessarily from the local area," he says. "We're talking about a pollution mass covering the entire mid-section of the country—an area from Louisiana to Minnesota and Kentucky to New England."

Lyons' theory, presented this past June to the Fourth Annual EPA Research and Development Conference on Energy and Environment in Washington, DC, is based on the interpretation of thousands of satellite photographs that have been computer analyzed over the past few years.

Lyons characterizes this observed "soup" as having elevated pollution levels running generally around 80 parts per billion.

Lyons describes a particular episode that took place on June 30, 1975: "On this day a high pressure system was stagnant. It drifted out from New York, out over Cleveland, picked up a bit more pollution in Pittsburgh, went through the Ohio River valley picking up some more pollution there."

The trajectory of the event, he says, suggests that after it passed through the Ohio River valley, where it picked up most of its sulfur dioxide, it went about as far west as Kansas City. It then made a strong turn north to Minnesota.

"I was a weather forecaster up there at the time," he notes, "and when we would get southerly breezes like these, I could automatically lop a few degrees from the high temperature, and drop the visibility to five miles."

The event that Lyons described lasted about four days with the entire states of Iowa, Wisconsin, and Minnesota covered with very polluted air that began out in the Ohio River valley.

"It usually takes a strong Pacific cold front from the west to blow that stuff out to sea," he adds.

Lyons remembers one particular "blob," as he calls these episodes, that, after having made a path similar to the one described above, headed 600 miles out over the ocean, turned south, then southwest, and three days later hit the Florida peninsula full blast.

Lyons has also been keeping his eye on how the blobs may be impacting agriculture. He is especially interested in the work being done by the University of Minnesota on the impact of ozone on the Nation's $8 billion annual soybean crop.

"We could be losing as much as 25 percent of that crop each year, because of the impact of ozone from these blobs on the plants at key times in the growing process," Lyons says.

At the University of Minnesota, 32 computer-controlled test chambers are located out in the middle of a soybean field where several varieties of the crop are being exposed to controlled concentrations of the pollutant.

"They're finding that when the smog blob passes over and you get 120 ppb for several afternoons in a row, about a 25 percent loss could be taking place," he says.

"We're seeing these blobs 1,500 miles off the east coast, just as thick as the day they left the area where the pollution came from." he warns.

Lyons says there is no doubt that the Ohio River valley, with its large concentration of power plants, is the major contributor to the nation's summer haze problem and to acid rain damage that comes when the blobs are sucked into clouds to make rain.

"One of the strangest things we've seen on these satellite pictures is these large masses of clouds with lots of little holes punched in them. For a long time, we couldn't figure out why there were these holes, but then we realized that what had happened was rain—the smog had been absorbed into the raindrops, and fallen out of the blob," Lyons said. "We've verified this by comparing precipitation data taken from the ground with the satellite pictures of

these holes. What we're seeing is acid rain actually being made."

"We can definitely see now that pollution from any given area is not just a local problem. Due to shifting weather fronts, it can be a problem on a regional, national— or even a global scale.
*—Frank Corrado, director of EPA's Region V Public Affairs Office, from* Environment Midwest.

**Florida Establishes Manatee Refuge**

Help is on the way to save the manatee, the endangered sea mammal thought to be a marine relative of the elephant.

The West Indian manatee (*Trichechus manatus*) is a retiring gentle vegetarian which can reach a length of 12 feet and weigh almost a ton. Adult manatees eat as much as 100 pounds of underwater vegetation daily. Despite its unflattering popular name "sea cow," the myth of a half woman, half fish sea creature—the mermaid—is thought to have stemmed from the first human sighting of this sea mammal with the expressive face.

Manatees were once fairly common along the coast of Florida and Georgia, but were exploited for meat, hides, and oil during the 17th and 18th centuries. Today, only about 800 to 1,000 West Indian manatees remain in Florida, plus another 100 in Puerto Rico.

Human activities such as recreational pursuits and environmental controls are the major cause of the manatee's disastrous decline. The U.S. Marine Mammal Commission concluded its 1978 Annual Report with the statement: "The species may well become extinct in the foreseeable future throughout its range in this country unless decisive, meaningful actions are taken to cope with the basic problem, which has been and remains one of controlling human activities."

Manatees, with a cruising speed of four to ten km an hour, typically float near the surface, within easy reach of boat propellers. These collisions are the main known cause of death among manatees—most bear deep ridges on their backs from encounters with motorboats, barges, or fishing vessels. Research now underway indicates that propeller size may be a more important factor than boat speed in manatee deaths.

Flood control structures with automatically-operated water level gates are another big contributor to the manatee's demise. Five such structures in Dade Country, under the jurisdiction of flood control districts, are the major culprits. Adjustments to prevent manatees from being caught or crushed by the gates, such as reducing their operating speed or adding structures to prevent entrance, require the cooperation of these units of government.

*Manatee diorama, Hall N*

The Game and Fresh Water Fish Commission of Florida, the state with nearly all the nation's manatees, is working with the U.S. Fish and Wildlife Service to create the equivalent of wildlife refuges for the manatee. Swimming, boating, snorkeling, scuba diving, and surfing have been restricted or banned in 13 of the state's manatee wintering areas, and another 12 may be posted before fall.

During the cooler months, manatees are attracted to the warm water outflows of power plants. When large numbers are gathered into these relatively small areas, the animals are more vulnerable to disturbances than during the summer months, when populations are more dispersed. However, this gathering into a more well-defined area also makes possible the creation of refuges to protect manatees during the winter.

Monofilament nylon fishing line discarded by fishermen causes problems for curious manatees, who may first play with it, but then become hopelessly tangled. Fishing nets or crab pot lines are another hazard.

The increasing pollution of inland streams destroys the manatee's food source. And sudden cutoffs of warm water discharges from generating plants (or extremely cold weather) may bring on thermal shock.

To compound the problem, the animals suffer from the curiosity or even the maliciousness of humans. Some are hounded to death by overeager photographers; others bludgeoned by gourmands of manatee venison. All told, nearly 100 die yearly from the above mentioned human influences.

Add to this the manatee's slow reproductive rate—one calf every five

years—and it's easy to see why its existence is threatened. Despite more than 70 years of protection, the decline continues. In 1907, Florida outlawed the killing or molesting of the huge beast, punishable by a $500 fine, or six months in jail, or both. In addition, it is protected by the federal Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973, violation of which carries a maximum $20,000 fine and one year prison sentence. Rewards of up to $2,500 are available for persons providing information leading to a conviction under the protection laws.

But these well-intentioned laws are only now being utilized. So, in 1976, under the provisions of the Endangered Species Act, the U.S. Fish and Wildlife Service appointed a "manatee recovery team" with the authority to write protective regulations and outline recovery efforts, including needed research. The team never acted or even met. A new team appointed in 1978 adopted some state-written regulations establishing ten basic protection areas. To enforce this protection, Florida has spent $81,000 posting these areas, and assigned half of its 240 marine patrol officers to police them in winter.

These new manatee protection activities are a step in the right direction, but whether they're long enough strides to span the yawning gap called "extinction" remains to be seen.—*Mike Leccese, National Wildlife Federation.*

(See also "The Remarkable Manatee, by Thor Janson, in the May, 1979, *Bulletin.*)

### A Whale of a Singer

Humpback whales, it turns out, are true composers of the animal world — their songs are continuously evolving.

Analysis of songs collected over a 20-year period reveals that the songs change progressively from year to year. According to Roger Payne, of the New York Zoological Society, the only other animal to exhibit such complicated behavior is man. Payne even compares it to the evolution of language.

The songs have a definite structure, even though humpback whales in, say, Hawaii will sing a different song than those in Bermuda. For example, each song contains about six themes that follow in the same order, and each phrase contains two to five sounds. If a theme is deleted, the others stay in order. Since the laws of composition are the same between two isolated herds, Payne feels that whales inherit, genetically or through learning, a set of song rules.

Since whales only sing in winter, researchers first thought song changes were the result of a flawed memory; the whales, they thought, forgot part of the song over the summer and improvised each fall upon returning to their winter grounds. But new recordings show that when whales return they sing last season's song flawlessly. Improvisations then occur as winter progresses. For instance, an old phrase may decrease in frequency as the weeks pass, only to be replaced by a new phrase.

So far, researchers are unable to define the purpose of these elaborate songs. They speculate that they may be love songs since they occur during what is believed to be the breeding season and they are only sung by adults. While all singers that have been closely studied are male, researchers are unable to determine the sex of most whales they observe. They also find it difficult to tell which whale is singing.

Humpback whales are the only known species to have a song, although other whales repeat a low monotonous loud tone that can be heard for hundreds, perhaps thousands of miles.

### Piranha Range Increasing

Piranhas are apparently extending their range in South America. Officials in the southern Brazilian state of Santa Catarina, beyond the previous range of the fish, reportedly have warned people against swimming in rivers.

This follows the disappearance of farm animals, attributed to piranhas, and a recent attack on two fishermen near the town of Florianopolis.

Press reports from Rio de Janeiro said the rivers of Santa Catarina were more than 2,500 km from the Amazon, normal habitat of the piranha. However officials said ducks migrating from the region often unwittingly carried piranha eggs stuck to their feathers, which would explain how the fish had appeared so far to the south.

### Man Sentenced for Violating Federal Wolf and Gun Acts

A Burton, Mich., man has been sentenced to three years in federal prison and fined $1,000 after pleading guilty to transporting two wolves into Michigan in violation of the Federal Lacey Act, and for being in possession of a firearm as a convicted felon.

He was sentenced to one year in prison and fined $1,000 on the wolf charge and sentenced to an additional two years on the firearms charge. The sentences are to be served concurrently. The man is believed to be the first person in the U.S. to be sentenced to federal prison for violating federal and state laws pertaining to the protection of wolves. The lengthy investigation, initiated in Minnesota, April, 1977, revealed that the man purchased two wolves from a fur farm and transported them into Michigan on May 30, 1979.

### 25 Animal Species Added to Endangered List

Several gazelles and deer, some from the Peoples Republic of China, and the rednecked Amazon parrot are among the 25 foreign species that have been classified as endangered by the Interior Department's U.S. Fish and Wildlife Service. The rule, listing the species from numerous countries in Asia, Africa, and South America, was published in the June 25, 1979, *Federal Register.*

Habitat destruction and subsistence or uncontrolled killing are the primary causes for most of the species' decline. All are considered endangered by the International Union for the Conservation of Nature and Natural Resources.

Listing the wildlife under the Endangered Species Act will aid in their conservation by prohibiting all interstate or foreign commerce of these species without a permit and by requiring federal agencies to refrain from funding, authorizing, or carrying out any activities in the affected foreign countries that would jeopardize the species' continued existence. Federal agencies must also utilize their authorities to promote the conservation of these species. As a result of the listings, foreign currencies and U.S. personnel also become available to assist the countries in developing management and conservation programs.

The newly classified endangered species and their countries of origin are: Iriomote cat—Iriomote Island, Ryukyus; Malabar large spotted civet—India; Bactrian deer—USSR, Afghanistan; Barbary deer—Tunisia, Algeria, Morocco; Corsican deer—Corsica, Sardinia; Yarkand deer—Chinese Turkestan; Jentink's duiker—Liberia, Sierra Leone, Ivory Coast; western eland—Senegal to Ivory Coast; simian fox—Ethiopia; Arabian gazelle—Arabian peninsula, including Israel; Pelzeln's gazelle—Somalia; sand gazelle—Arabian peninsula, Jordan; Saudi gazelle—Israel, Iraq, Jordan, Syria, Saudi Arabia, Kuwait.

Swayne's hartebeest—Somalia, Ethiopia; Tora hartebeest—Ethiopia, Sudan, Egypt; Fea's muntjac—Burma, Thailand; Ryukyu rabbit—Ryukyu Islands; Formosan sika—Taiwan; North China sika—Shansi Province, China; South China sika—Yangtze valley, China; Zanzibar suni—Zanzibar Island, Tanzania; Arabian tahr—Oman; rednecked Amazon parrot—Dominica.

# September & October at Field Museum

*(September 15 through October 15*

### Continuing Exhibits

**"Treasures of Cyprus."** A final opportunity to view 8,000 years of Cypriot art and culture. . .this is the last showing before the exhibit's permanent return to Cyprus. Ancient bowls, jugs, vases, jewelry, and religious idols show the influence of many peoples while remaining typically Cypriot. Assembled under the direction of Donald Whitcomb, assistant curator of Middle Eastern archaeology and ethnology. Exhibit designer is Clifford Abrams. Sponsored by the Smithsonian Institution Traveling Exhibit Service and the government of Cyprus. Hall K, ground floor. Through Sept. 16.

**"Art Lacquer of Japan."** Our newest permanent exhibit features *inro* (intricately carved and decorated sectional medicine cases), *netsuke* (tiny carved pendants), and *ojime* beads, which hung from the waists of 18th- and 19th-century Japanese men as symbols of wealth and status. Miniature landscapes, dreamlike still lifes, and mythic dragons are flawlessly carved into lacquer ornaments no larger than a matchbox. Examples of Chinese lacquer art are exhibited for comparison. Designed by David Edquist under the direction of Bennet Bronson, associate curator of Asian archaeology and ethnology. Hall 32.

**"A Stamp Sampler: Postage from Natural History."** A one-case exhibit that combines 63 natural history specimens with samples of philatelic or stamp art. Planned on a rotating basis to cover the four disciplines of natural history, the first phase is devoted to zoological specimens and their images on stamps. Among the mounted specimens are exquisite seashells, butterflies, a leaping jaguar, and a fox. "A Stamp Sampler" was conceived by Col. M. E. Rada, exhibit guest curator, and designed by Peter Ho, a University of Illinois graduate student. Second floor lounge.

**"Cash, Cannon, and Cowrie Shells: The Nonmodern Moneys of the World."** A fascinating collection that contains over 80 varieties of money used by ancient cultures. It explores the origins, values, and meaning of nonmodern money in terms of buying power for these past civilizations. The accompanying text gives the value of each form of money in terms of how much food it could then buy. Four general categories of moneys are on display: metal coinage, uncoined metal, shell money, and "miscellaneous," which includes food, fur, fiber, glass, teeth, and stone currencies. No closing date. Between Halls K and L, ground floor.

**The Place for Wonder.** This gallery provides a place to handle, sort, and compare artifacts and specimens. Weekdays, 1:00–3:00 p.m.; weekends, 10 a.m. to noon and 1:00–3:00 p.m. Ground floor, near central elevator.

**Friend or Foe? The Natural History Game.** The object here is to determine which one of apparently similar specimens is harmful and which is not. See if you can distinguish a vampire bat, a headhunter's axe, a poisonous mineral, or a deadly mushroom from its benign look-alike. Ground floor, no closing date.

*(Continued on back cover)*

*Field Museum's newest permanent exhibit, "Art Lacquer of Japan," in Hall 32*

MISS EDITH FLEMING
946 PLEASANT STREET
OAK PARK ILL 60302

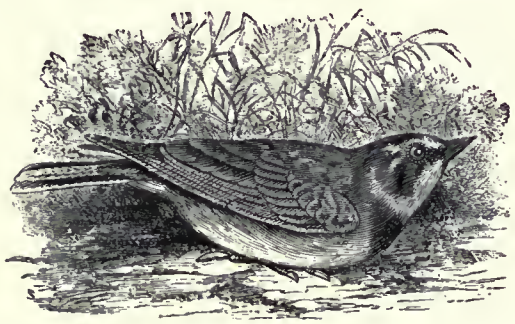
# September & October at Field Museum

*(Continued from inside back cover)*

## New Programs

**"Jungle Islands."** Film of the 1928-29 Crane Pacific Expedition. Scientific staff from Field Museum, Harvard and Stanford universities joined young Cornelius Crane and three college friends aboard the *Illyria*, a 150-foot sailing ship built by Field Museum trustee Richard T. Crane as a gift for his son. This 90-minute account of their adventures documents the acquisition of exotic animals and provides a rare ethnological record of the native peoples of New Guinea, Marquesas, New Hebrides, and Solomon Islands. Introduction and commentary during the silent, black-and-white film is provided by Dr. Robert F. Inger, Field Museum curator of reptiles and amphibians. Saturday, Sept. 29 at 2:30 p.m. James Simpson Theatre, West Entrance. Members $2.00; nonmembers, $3.50. An optional Members' buffet luncheon ($3.00) at 12:30 precedes the film. For coupon see p. 24.

**Coming in October.** Learning Museum Program, a 3-year sequence of learning opportunities centered around Field Museum's exhibits and collections and funded by the National Endowment for the Humanities, begins with a keynote address by Dr. Jonathan D. Spence. The noted China historian and Yale University professor will speak on "Looking at China: When, How Deeply, and Why?" Friday, Oct. 5 at 8 p.m. For further information see p. 25.



## Continuing Programs

**"Weekend Discovery Programs."** Free guided tours, demonstrations, and participatory events. Check weekend sheet available at North Information Booth for additional programs and locations.

"Ancient Egypt." 45-minute tour explores traditions of everyday life, Egyptian myths, and the importance of mummies. Saturday, Sept. 8 at 11:30 a.m.

"Baobab." This African wilderness film portrays the giant baobab tree as a miniature world where various species of insects, reptiles, birds, and mammals find protection and make their home. Saturday, Sept. 8, at 1:30 p.m.

"Indian Fishermen of the Northwest Coast." The survival, wealth, prestige, daily and ceremonial life of these people are centered on the fish harvest. Sunday, Sept. 9 at 1:30 p.m.

"Early Man." Half-hour tour traces major trends in the physical and cultural evolution of man. Saturday, Sept. 15 at 11:30 a.m.

"Mzima: Portrait of a Spring." This African wilderness film focuses on the hippopotamus and shows how its springtime survival ensures the continuing existence of other species. Saturday, Sept. 15 at 11:30 p.m.

"Life in Peru." A 30-minute slide presentation of life in ancient Peru and its ties with modern Peru as interpreted through pre-Inca pottery. Sunday, Sept. 16 at 12 noon.

"Introduction to Hopi Culture." 30-minute film explains the rich heritage of the Hopi religion. Saturday, Sept. 22 at 11:30 a.m.

"Ancient Art of Spinning." Demonstration and talk on spinning's development in several cultures. Saturday, Sept. 22 from 12:30 to 2 p.m.

"Kenya-Uganda Safari." An African wilderness film showing the varied landscape and wildlife of East Africa. Saturday, Sept. 22 at 1:30 p.m.

"Endangered Animals." Half-hour introduction to animals in danger of extinction. Sunday, Sept. 23 at 1 p.m.

"China Through the Ages." Rare turn-of-the-century lantern slides featured in this look at traditional China. Saturday, Sept. 29 at 1:30 p.m.

"Indians of North America." A film tour of six tribes, from Iroquois in the north to the Hopi in the southwest. Sunday, Sept. 30 at 2 p.m.

**Kroc Environmental Field Trips.** One-day trips are held each weekend with Museum staff and guest scientists leading the explorations. Adults and family groups can learn about local flora, fauna, and geology by collecting fossils, hiking through nature areas, or visiting working farms. Advanced registration by mail is highly recommended. For more information or a field trip brochure, call 922-9410, ext. 362, or write Department of Education—Field Trips, Field Museum, Roosevelt Road at Lake Shore Drive, Chicago, 60605.

**On Your Own at Field Museum.** Self-guided tour booklets, adult-and-family-oriented, are available for 25¢ each at the entrance to the Museum Shop, main floor north.

**Volunteer Opportunities.** Limited opportunities are available in botany, geology, and zoology. Weekend volunteers with an interest in natural history are needed to develop and present weekend programs. For more information call 922-9410, X 360.

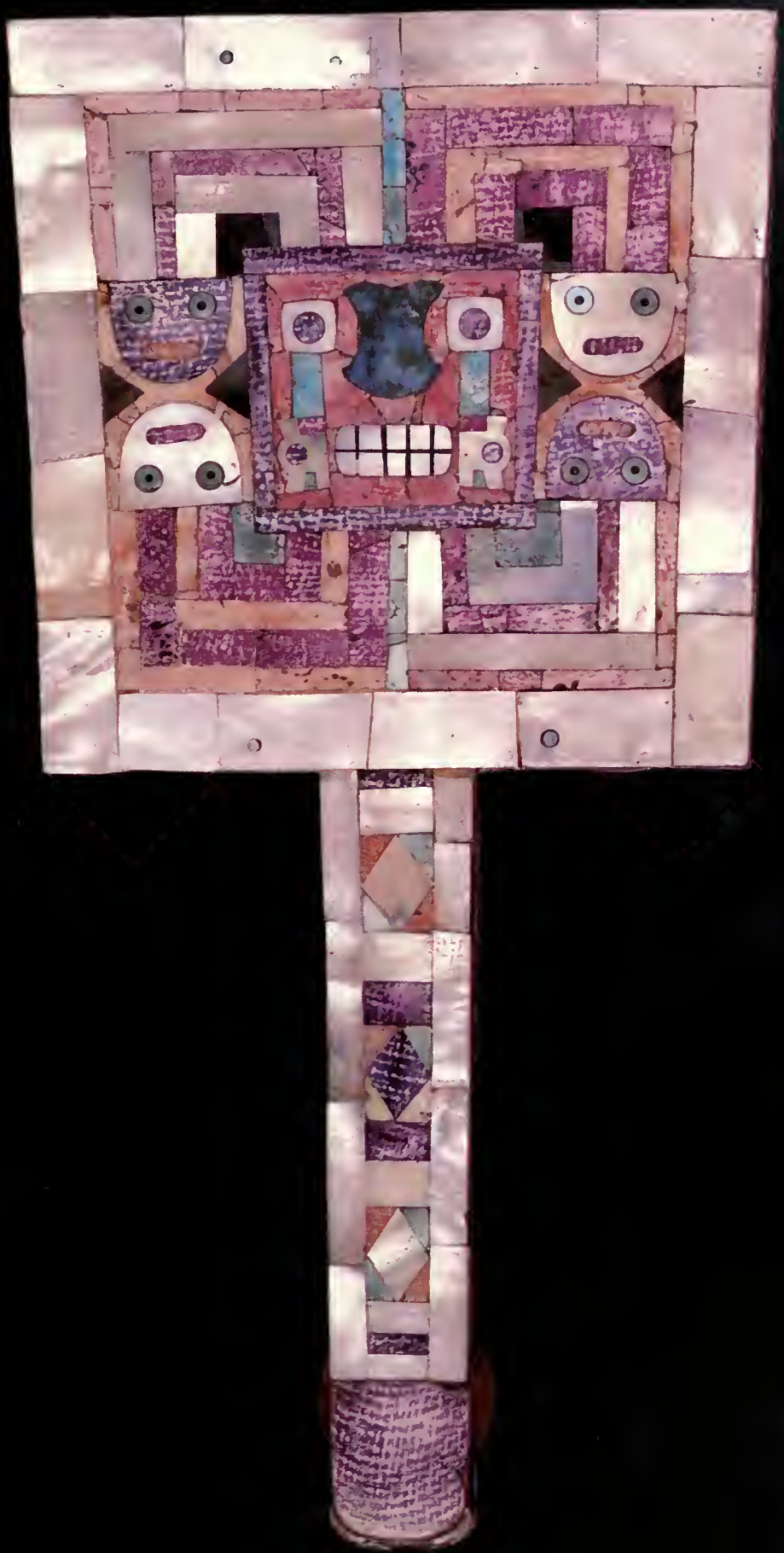
**September and October Hours.** The Museum is open daily from 9 a.m. to 5 p.m. except Fridays. On Fridays, the Museum is open from 9 a.m. to 9 p.m. throughout the year.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at the reception desk, main floor.

**Museum Telephone:** (312) 922-9410

October
1979

# FIELD MUSEUM OF NATURAL HISTORY BULLETIN



# Field Museum of Natural History Bulletin

October, 1979
Vol. 50, No. 9

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## Field Museum of Natural History

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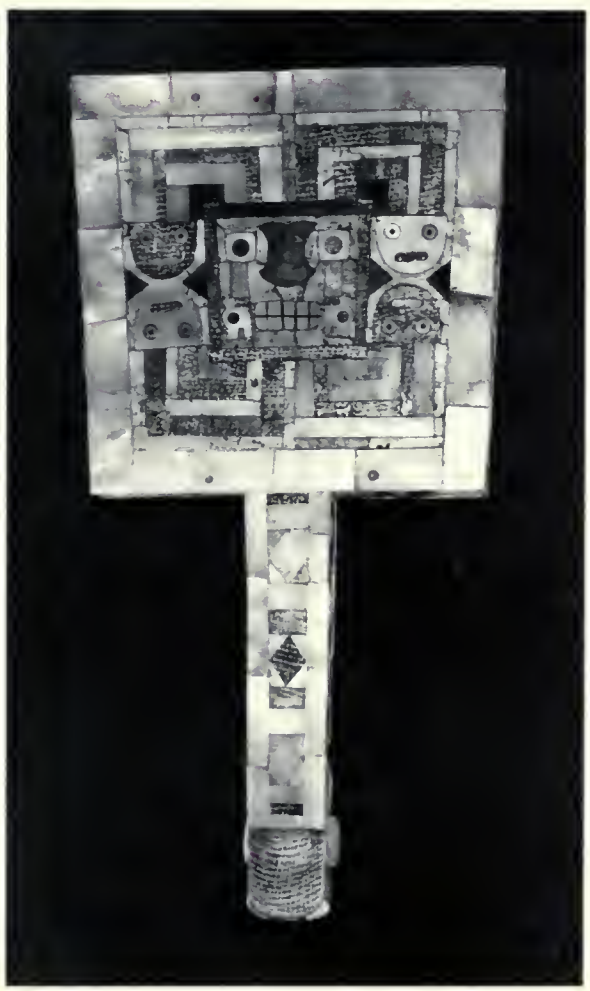
*Mosaic mirror of turquoise, mother of pearl, and shell cemented with resin to a wooden base. The reflecting surface on the opposite side is made of inlaid, highly polished pyrites. This mirror is one of the finest known examples of portable art in the Huari-Tiahuanaco style. 23.9 x 12 cm. From the Robert Woods Bliss Collection of Pre-Columbian Art, Dumbarton Oaks, Washington, D.C. Photo courtesy Dumbarton Oaks. See "Archaeology at the Top of the World," p. 16, by Alan L. Kolata.*



# Field Museum Tours

**Peru, Oct. 27-Nov. 15.**

A 20-day tour will visit the ruins of Machu Picchu, Chan Chan, Pachacamac, Purgatario, and others. The Plains of Nazca (viewed from low-flying aircraft), the Guano Islands, and the Pisac Indian Fair will also be visited. The group, limited to 20, will be led by Dr. Michael Moseley, associate curator of middle and South American archaeology and ethnology, and by Robert Feldman, assistant in archaeology. A tour escort will also accompany the group.

The tour cost—$2,998 (which includes a $500 donation to Field Museum)—is based upon double occupancy and includes round trip air fare between Chicago and Peru and local flights in Peru. Delta Airlines will be used between Miami and Chicago, connecting with Aeroperu. Deluxe accommodations will be used throughout. The package includes all meals, including inflight meals; all sightseeing; all admissions to events and sites; all baggage handling; all necessary transfers; all applicable taxes and tips; all applicable visa fees. Advance deposit: $250.00 per person.

**China, Nov. 5-25**

Peking's Forbidden City, the Summer Palace of the Dowager Empress, the bustling activity of Canton, the ancient pagodas of Kunming. These are just a sampling of the sights that lie in store for the 23 persons (Field Museum members and their families) who visit China on Field Museum's exclusive tour this November.

In addition to fourteen days in China, three days and two nights will be spent in London. The tour escort will be Mrs. Katharine Lee, a Field Museum volunteer in the Department of Anthropology who is fluent in five Chinese dialects. Additional guides in China will be provided by the China International Travel Service. The tour cost—$4,400 (which includes a $500 donation to Field Museum)—is based upon double occupancy and includes round trip air fare from Chicago to China. Advance deposit required: $500.00 per person.

**Antarctica, Jan. 6-30, 1980**

Until recently, only explorers were able to view antarctica's wondrous beauty. There is no destination more remote, more unspoiled by the encroachments of civilization. Our itinerary includes the Falkland Islands, a visit to the Patagonian coast, the South Georgia Islands, the South Orkney Islands, and of course, antarctica. Dr. Edward Olsen, curator of mineralogy, will be tour lecturer.

The cruise vessel will be the 3,200-ton ship *M.S. World Discoverer*, registered in Hong Kong, which will take us from Punta Arenas, Argentina, onwards. Built in 1974, the one-class vessel has all outside cabins with private lavatories and showers. The ship's staff includes a fully qualified physician. The tour leaves Chicago Jan. 6, 1980 and returns Jan. 30. Prices per person: C deck twin: $3,230; C deck single: $4,870; B deck twin: $3,570; B deck single: $5,390; A deck twin: $3,930. Air fare, in addition is $1,225 (round trip between Chicago and Punta Arenas, Argentina). Included in the tour price is a tax-deductible donation of $500.00 to Field Museum. Deposit required at time of registration: $1,000.00 per person.

**Archaeological Tour of Egypt with Nile River Cruise Jan. 31-Feb. 17, 1980**

Field Museum once again presents its popular Egypt tour with a Nile River cruise. This is the fourteenth such tour offered to Members during the last four years. The new and improved program offers an 11-day Nile cruise on our own chartered, private, modern Nile steamer. In addition, we will be visiting Cairo, Memphis, Sakkara, Aswan/Abu Simbel, Edfu, Esna, Kom Ombo, Luxor, Thebes, Valley of the Kings and Queens, Dendereh, Abydos, Amarna, Middle Kingdom Tombs at Beni Hasan, Pyramid at Medum, and much more.

Eighteen days exploring Egypt with our Egyptologist, Mrs. Del Nord, a doctoral candidate at the Oriental Institute of the University of Chicago, who has traveled extensively in Egypt. Leave Chicago on January 31, 1980, and return on February 17. Price includes all air transportation, meals, Nile cruise, hotels, tips, taxes, transfers, visa fees, admissions, baggage handling, escorts, and more. $3,595.00 per person based upon double occupancy. The tour price includes a $500.00 contribution to the Field Museum. A $500.00 per person deposit is required for reservation confirmation. The group is limited to 30 persons. Single supplement is available upon request, Nile Cruise and land.

**Kenya Safari Feb. 13-March 5, 1980**

The wildlife of Kenya, both plant and animal, will be the focal point of this exciting 22-day tour of Kenya. An added bonus will be one of nature's most spectacular phenomena, a total eclipse of the sun which will occur on Feb. 16, 1980, and which you will view from the perfect vantage point, the Taita Hills. On the tour you will visit Nairobi, Amboseli beneath Mt. Kilimanjaro, Tsavo West, Tsavo East, Mombasa on the Indian Ocean, the Ark, Samburu, Mt. Kenya Safari Club, Lake Naivasha, Masai Mara adjoining the Serengeti, and more.

The tour will be led by Dr. Robert Faden, assistant curator of botany, and his wife, Audrey Joy Faden. Dr. Faden lived in Kenya for more than seven years and is very well versed in the flora. Audrey Faden, a wildlife artist, was born and raised in Kenya and has a first-hand knowledge of the fauna.

The tour leaves Chicago on Feb. 13, 1980, and returns March 5. Price includes all air transportation, meals, transportation within Kenya, hotels, tips, taxes, visas, transfers, baggage handling, admissions, escorts, and more. The tour cost is $4,575.00 per person based upon double occupancy from Chicago; this includes a $500.00 contribution to Field Museum. A $750.00 deposit per person is required for reservation confirmation. The group is limited to 25 persons. Single supplement is available upon request.

*For additional information and reservations for all tours, call or write Michael J. Flynn, Field Museum Tours, Roosevelt Rd. at Lake Shore Dr., Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.*

# OUR ENVIRONMENT

### Sperm Whale Stranding—Why?

Why? Why did 41 sperm whales (*Physeter macrocephalus*) beach themselves about one mile south of the Siuslaw River [on the Oregon coast] during the early evening hours of June 16, 1979? The answer to that question as of this writing is not known and may never be known. However, when all of the data collected from this stranding is analyzed, scientists may be a little closer to answering this question.

The sperm whale is the largest of the toothed whales and is found in the Atlantic, Pacific, and Indian oceans. Male sperm whales may grow to 60 feet in length; however, few are found that exceed 50 feet in length. They feed mostly on squid and octupus although occasionally they are known to feed on fish.

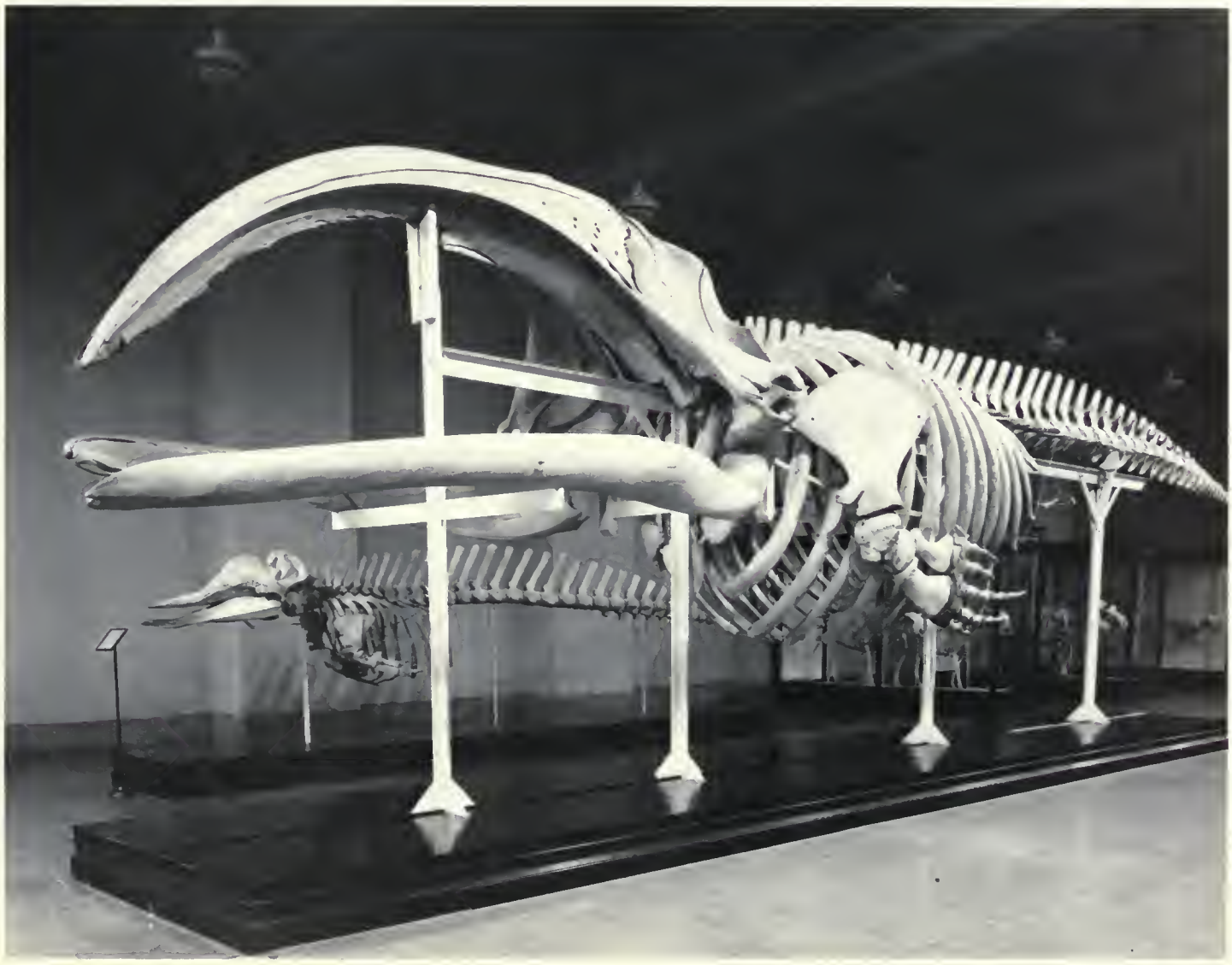
The sperm whale breeding season off California and presumably in Oregon is from May through October. After a 15-month gestation period the female gives birth to a single calf about 12 to 15 feet in length. To nurse her calf the mother lies on her side at the surface; the calf, lying parallel to its mother, takes her teat sideways in the angle of its jaw. The milk is pumped into the calf's mouth by means of a muscle layer covering the mammary glands. The calf nurses for one to two years and may take some solid food months before being weaned. The female does not come into estrus again for several months to over a year after weaning, thus she can bear only one calf every three to five years.

Sperm whales dive to great depths to feed on squid, octopus, and bottom fish. Sperm whale carcasses have been found entangled in submarine cables at depths exceeding 3,000 feet. Researchers, tracking sperm whales with sonar, report the usual dive depth is around 1,600 feet; however, they have been located on sonar at over 8,000 feet. Two animals killed off Africa after an 80-minute dive had fresh bottom fish in their stomachs. The water in that area was over 10,000 feet deep.

Researchers say that most sperm whale populations are still at or above the level that provides the maximum substainable yield. They estimate the present world population at about 800,000 adults (roughly 1.5 million total, including young animals) of which 380,000 (or about 740,000 total) are in the North Pacific.

This was the fourth largest re-

*Skeleton of 50-foot black right whale on view in Hall 19. This species is about the same size as the sperm whale, discussed above. Photo taken in 1920s; skeleton is now suspended from ceiling.*



ported mass stranding of sperm whales in the world. The most recent larger stranding occurred New Year's evening (1979) in the northern Gulf of California. Why these strandings occur is not known; however, there are some theories as to the cause. Sperm whales detect food and navigate with echolocation (sonar). Three theories on the causes of strandings are related to echolocation: (1) parasites may invade that part of the inner ear responsible for "balance," making it hard to keep the blowhole at the surface; this may also disrupt the animal's ability to interpret reflected sound; (2) long-sloping, shallow beaches may "capture" the echolocation signals as they reflect off the bottom so the animals do not detect this danger until it is too late; and, (3) one or more animals in the pod may be ill or disoriented and swim to the beach with the remainder of the pod following. Captain C. M. Scammon, in his book "Marine Mammals of the Northwestern Coast of North America," noted that sperm whales, particularly the females, would remain with an injured (harpooned) animal, thus allowing several in a pod to be killed before they tried to escape.

There is also the question of why these animals, normally found offshore in deeper water, were so close to the beach. One possibility is that this is the time of year when squid are found near shore depositing their egg capsules on hard objects such as rocks and crab traps. Squid were reportedly spawning near the stranding site. Sperm whales were observed just offshore in this area prior to and following the stranding. It is not known whether these whales were from the same pod as those that stranded or if they showed any signs of illness.

The stranding and death of 41 sperm whales was a tragic occurrence. The stranding fortunately coincided with the annual meeting of the American Society of Mammalogists at Corvallis and as a result some of the leading mammalogists of the United States and Mexico were nearby and gave valuable assistance in collecting data. All animals were measured, sexed, and will soon be aged by observing annular laminations of their teeth. In addition, over a dozen animals were dissected. Tissue samples of all major organs were taken for disease, parasite, and pollutant determinations. Three fetuses close to birth were examined and will contribute to our understanding of sperm whale development.

Many people wonder why the animals were only examined for biological purposes and no utilization was made of the carcasses. While it would have been very difficult, if not impossible, to cut the animals up and get them to rendering plants before decomposition began, the greatest problem was concern for public health. Health authorities did not think it wise to "drip" whales (possibly diseased) to rendering plants because of potential risk to humans, livestock, and terrestrial wildlife. There were also legal questions. The sperm whale is on the U.S. endangered species list. The Endangered Species Act and the Marine Mammal Protection Act specifically prohibit the sale, use, or possession of any marine mammal parts without special permits. Exception to the law for salvage rendering could have been made if the possibility of disease could have been ruled out.—*Dale Snow, assistant marine region supervisor, state of Oregon, and Bruce R. Mate, Oregon State University, from* Oregon Wildlife.

### A Scent's Worth Suffices

A skunk discharges only about a twentieth of a teaspoonful of fluid when it utilizes its well-known, smelly defense mechanism. This fluid is under pressure and it is released in a very fine spray that can carry up to 20 feet.

### Asleep in the Deep Freeze

A handful of arctic lupine seeds holds the world's record for living in an inert state, according to the National Wildlife Federation. The seeds began to sprout in a dish of warm water after lying frozen deep in the tundra for 10,000 years.

### Hair as Repellent

Wildlife biologists at the New York Botanical Garden's Cary Arboretum have been letting their hair hang down in an experiment to determine if the hair repels deer.

Jay McAninch, staff biologist at the arboretum in Millbrook near Poughkeepsie, NY, explained that bunches of human hair wrapped in nylon nets have been suspended from about 200 trees on the 2,000-acre arboretum. In measuring a hair ball's "sphere of influence" deer consistently would come within only one meter of the hair ball. This year the program, funded by grants from a beauty salon firm, has been expanded to test what types of hair repel deer, how long the hair balls are effective and packaging techniques for different tree species. Tresses from beauty salons and the great unwashed mass of hair from barbershops is being used.

The rationale behind the search for a repellent is that deer browsing in orchards, nurseries, woodlots, farms, and gardens is a big problem—not only in New York but anywhere that agriculturalists and deer share the same territory. The hair ball idea is not exactly new. McAninch said he heard about it from two gardeners who had read about the idea in an organic gardening publication. Results, however, varied from one orchard to the next; McAninch wanted to set up an experiment that would eliminate many of those variables so that more conclusive results could be uncovered. He was also attracted to the method because it is inexpensive, readily available, nontoxic and fully biodegradable.

McAninch theorizes that the hair may be repugnant to the deer because of some human scent associated with it, possibly from hair follicle secretions. Follow-up chemical analyses of the different types of hair are planned to substantiate this theory.

What will the deer eat if the hair balls are too effective, one might ask? Good question, but McAninch has an answer. The number of hair balls is "minuscule" compared to the amount of browse on the arboretum grounds. On the smooth sumac, for example, one of the five preferred browse species, the balls adorn only about one-tenth of one percent of the available twigs and branches. "We wouldn't try to extensively modify the deer food habits," he noted. —*Rose Houk,*
*National Wildlife Federation.*

# Timeless Images: Museum Photography

*By Patricia Williams*

Field Museum's Department of Photography was established in 1895 and has been snapping away ever since. In those 84 years a lot of film has gone past the shutter — enough to produce a unique and irreplaceable collection of some 300,000 negatives, 1,500 color transparencies, 10,000 lantern slides, and 60,000 glass plates. According to Ron Testa, Museum photographer, one of the greatest satisfactions of his job is being "caretaker of that gigantic file of negatives which we find is becoming more and more important to the history of photography and to the history of Indians especially. This collection will stay around for posterity and people will have access to it hundreds of years after I'm gone."

The department was originally set up because, according to the Museum's first annual report, it was found that the two-year-old museum needed photographs to illustrate publications and lectures, "as well as preserving numerous conditions and objects that could in no other way be illustrated in the collections of the museum."

Fulfilling that broad and rather vaguely defined need has resulted in a collection of great diversity. There are photographs taken on expeditions to exotic places and to America's then barely settled West; of people from many races and cultures; of anthropological, botanical, geological, and zoological specimens; and scores of shots of exhibits. Lantern slides and photographs by the noted photographer of the American West, William Henry Jackson, are in the collection, as are negatives from Adam Clarke Vroman, the famous photographer of the Southwest. The history of the Museum itself—from its original site in Jackson Park through the massive move to the present building and, most recently, through the just-completed renovation—is also preserved on film.

Who uses all these pictures? Lots of people. Publishers request photos for use in encyclopedias, books, magazines, and newspapers. Students, scientists, historians, and researchers from all over the world draw on Field Museum's photography collection for use in their studies. For example, the Instituto Nacional de Pesquisas de Amazonia in Manaus, Amazonas, Brazil, recently placed an order for one of each of the 55,000 negatives in the Museum's Botanical Type Photograph Collection. Fleur Hales, photo technician, is expected to spend at least four years filling that order in addition to performing her other duties.

A botanical type specimen is the original specimen on which the description of the plant and the Latin name is based. In systematic botanical work, which primarily concerns the naming and classification of plants, it is essential that specimens be correctly identified. This can be done only by comparison of the plant in question with the type specimen. Photos greatly facilitate botanists in their determinations and are almost as good for study purposes as the original specimen—especially if only fragments of plant material are available for corroborative study.

The Museum's Botanical Type Photograph Collection did not "just happen," but was the result of a timely plan conceived in 1929 by B. E. Dahlgren, then acting curator of the Department of Botany, funded by the Rockefeller Foundation, and put into effect by botanist J. Francis McBride. The basic idea was to photograph the type material in European herbaria that was generally unavailable to botanists who were unable, for one reason or another, to visit those institutions.

For four-and-a-half years McBride travelled across Europe, finally producing about 30,000 negatives of type specimens. Since that time the collection has been supplemented until it now numbers some 55,000 negatives. Its value to science has also grown, especially since many of the types photographed by McBride were destroyed during World War II and Field Museum's photos are the only remaining record of them.

Another unique record was compiled when George A. Dorsey, curator of anthropology, travelled to the West and Northwest Coast to enlist Indians of various tribes and physical types to come to the 1904 World's Fair in St. Louis. Charles Carpenter, the Museum's first fulltime photographer, photographed all of these Indians in their native costumes against a painted background. Five thousand negatives resulted—negatives that are still in steady demand today.

Ron Testa explains, "Carpenter's negatives

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*Patricia Williams was formerly managing editor of scientific publications.*

are more authentic than those of many photographers who travelled around the Southwest bringing their own costumes along." These vagabond photographers often carried their own props and would happily outfit an Indian subject with whatever regalia was handy. In this way a Sioux might be ornamented with bits and pieces from various tribes— a headband from the Ute and a Pawnee pipe, for example. Although the results of such strategy might have been attractive, they were not culturally accurate and are not useful to anthropologists and historians today.

Much of the Museum's early anthropological field work was done in the Southwest and anthropologists either took the Museum photographer along or hired freelance photographers on the scene. Donna Longo, on an Illinois Arts Council grant, recently completed a several months' "treasure hunt" through the Museum's photographs of the Southwest Indians. Her purpose was to discover what photographers between 1890 and 1920 were doing among the Hopi; what their influence was on Hopi life; what kinds of images of the Hopi they captured. Most of what Americans knew at that time about these Indians they learned from photographs; Longo's objective was to determine just how accurate these representations were.

This was no easy task, and her conclusions are now being prepared for a formal report. As she observed, "You can never presume anything from any photograph." Documentation is vital to the value of photographs as sources of information and, unfortunately, many of the early photographs in the Museum's anthropology collection are poorly documented. Some were taken to be used as "accessories" to monographs and were not seen as important in themselves; others came from photographers who made only brief notations, such as "Sioux man, 1898." Information such as date, specific place, name of the subject, and the name of the photographer was simply not recorded.

Longo also drew information from published sources, notes in Museum archives, and correspondence from photographers and ethnographers, building a body of information and documentation about individual photographs that will make them useful tools in anthropological research.

*Botanist J. Francis McBride (1891-1976) spent more than four years photographing 30,000 type specimens in European botanical collections. Since many of these plant specimens were destroyed during World War II, McBride's negatives, now in Field Museum's photo collection, are in themselves an invaluable scientific resource.*

Loran Recchia, the Museum's photo researcher, is doing similar work on the many other materials in the Museum's collection of photographs. Unfortunately, over the years clerical help was lacking in the Department of Photography and only a chronological card file was maintained of the huge collection. Also, in many instances photographs were misidentified or shelved in various departments without any documentation at all.

*Charles Carpenter (1859-1949), Field Museum's first fulltime photographer, "shoots" Hopi while Museum anthropologist George A. Dorsey (1868-1931) takes notes.* Ca. *1900-01.*

*Botanist B. E. Dahlgren (1877-1961) was the originator of Field Museum's Botanical Types Photograph Collection.*

Pointing out the fact that the most important part of the file is retrieval, Testa and Recchia plan to completely recategorize the photographs in the collection, gathering information and entering it on file cards in a format suitable for transfer to a computerized system. The photographer also looks toward conservation of the negatives and glass plates themselves. Carol Small Kaplan, Museum photo technician who divides her responsibilities between the scanning electron microscope laboratory and the Department of Photography, is presently working on the preservation of early negatives. Some of these negatives weren't washed and processed properly and, warns Testa, "They could be deteriorating and we've got to try to prevent that." He continues, "To me it's a sin that we're even making prints off of some of our glass plates because they could be broken and lost forever."

It is Testa's goal to recategorize and document the collection and to preserve the old negatives and plates. The importance of this ambitious project is generally well established today and other museums with similar problems are also at work conserving their photographic collections. Testa hopes to obtain funding from a foundation or granting agency to finance this necessary project.

This is all a long way from the Museum's first foray into photography in 1895. Then, Charles F. Millspaugh, curator of botany, added photography to his other duties and took charge of a three-camera set-up housed in "one of the rooms in the North Balcony." When work picked up, as it soon did, Millspaugh was given an assistant from the librarian's staff.

The pace continued to accelerate and in October of 1899 Charles Carpenter joined the Museum staff as full-time photographer. Obviously not a job-hopper, Carpenter manned the shutter at the Museum for 48 years, until his retirement in 1947. In 1921 Herman Abendroth came to the Museum to work as Carpenter's assistant and, following Carpenter's retirement, served as head of Photography until his own retirement in 1950. John Bayaliss, who joined the Museum staff in 1925, became Abendroth's assistant in 1948 and head of Photography in 1950, serving in that capacity until his retirement in 1975. Today he continues to serve the Museum as a once-a-week volunteer, dividing his time between Photography and the Department of Botany. Following tradition, Ron Testa, who joined the staff in 1975, should be on hand to document the next turn of the century at Field Museum.

Before he came to Field Museum, Testa noted that among museum photographers nationally there was a tendency to pick a spot and stay in it. He explains: "Someone has to die or retire before you get

*John Bayaliss, head of Photography from 1950 until his retirement in 1975, came to the Museum in 1925. He is still active as a Museum volunteer.*

*Field Museum's Department of Photography (left to right): photo technicians Fleur Hales and Carol Small Kaplan, photographer Ron Testa, and photo researcher Loran Recchia.*

one of these jobs." Why? "Because people stay in it. It's very stable. They like what they're doing. John Bayaliss certainly liked what he was doing. I certainly like what I'm doing. Carpenter probably had a good time. I like museums and the museum atmosphere is very comfortable. It's sort of like a family."

Variety is certainly an outstanding characteristic of the job. One morning might find Testa snapping away at a group of school children touring a new exhibit and that afternoon he could be back in the studio adjusting the lighting for shooting fossils. He has taken the glamourous photographs for the "Feather Arts" catalog and late in 1978 he accompanied a geological field trip to Argentina. The fact that every Museum department —actually, every curator—has a different need for photography is Testa's greatest challenge.

Having taken 5,000 negatives and 500 transparencies since he joined the Museum, Testa has seen a steady increase in the demand for photographs. Because most of the Museum's collection is in black-and-white, many photographs are now taken in color to satisfy the current requests from publishers.

As part of the Museum's recent renovation program and aided by generous gifts from Mrs. David W. Stewart of Rochester, N. Y., in memory of her aunt, Hedwig H. Mueller, the Department of Photography recently moved into new quarters. Black-and-white developing is done in the Museum's new darkroom, but color photographs are developed for the department by commercial laboratories. Testa explains that it doesn't work out economically to develop color in-house yet. "The color chemicals die quickly. You have to use them almost every day or you're losing money. We have it done outside and in the long run it's cheaper."

The department's equipment includes an 11×14 Deardorff vertical; an 8×10 roll-around Deardorff; a 4×5 Sinar with a 90 mm single-angle lens; a 500 CM Hasselblad with an 80 mm lens; and a Nikon FM with a 55 mm lens.

It's all—again—a long way from a little balcony room in 1895, but, as well-known photography authority Aaron Sussman has written, photography can be perfectly described by "that sage French proverb: The more things change, the more they are the same. True, techniques have improved; materials and equipment are better, faster, or easier to use. But the eye and heart of the photographer are still the same, and the simplest camera with ordinary film can still make great pictures if the artist sees clearly and presses the button at the decisive moment." Field Museum has been fortunate in having a series of photographers who consistently saw clearly and carefully timed their button pressing. □

*Charles F. Millspaugh (1856-1923), Field Museum's first curator of botany, also established, in 1895, the photography department.*

# Of Automobiles And Meteorites

By Edward Olsen

Down in southern Illinois, 40 miles northeast of St. Louis, is a little town with an odd name, Benld — named after the late Ben L. Dorsey, who owned land in the area. On September 29, 1938, Benld became the site of a dubious first in the history of the automobile: A fine old 1928 Pontiac coupe, sitting in the garage of Mr. Ed McCain, had the honor of being the first automobile ever hit by a falling meteorite!

It was just after 9 o'clock in the morning, and Mrs. McCain was out back of her house pumping water from the well. Over the clanking sound of the pump she heard a loud noise and glanced up, thinking it was a passing airplane. She'd become quite used to the comings and goings of planes at the nearby St. Louis airport. But seeing nothing, she shrugged it off and continued pumping.

Meanwhile, across the alley, Mrs. Carl Crum was doing some yard work. Suddenly, she too, heard a sound which seemed to her like an airplane in a dive, followed by a sharp, cracking noise. She ran into the alley, thinking a small plane had smashed into the other side of her barn. Nothing appeared wrong, so she too dismissed it as some sort of fluke of nature — and indeed it was.

The rest of the day went along in normal fashion until Ed McCain arrived home from the local mine where he was employed. It was about three in the afternoon and he decided to drive into town to do some errands. Going out to the garage — an old, unpainted squarish building — he opened the doors and started to climb into the car. Then, to his astonishment, he discovered in the seat cushion a large ragged hole. McCain's first thought was that rats during the night had foraged in the cushion for nesting material. The old seat was made of mohair and stuffed with the conventional seat-stuffing materials of the day: cotton, wool, and burlap.

McCain's neighbor, Carl Crum, was just across the alley and McCain called him over to commiserate with him over the depredations of the rats. But peering at the hole, Crum expressed the opinion that rats could not have done such damage. Then, glancing upward, Crum noticed a hole torn through the new roof of the car. In cars of this vintage (before the advent of full metal roofs) the top was covered with a weatherproof fabric. A new roof had only been recently put on the ten-year-old car. Next, the perplexed men could see daylight through a splintered hole in the garage roof. The tarpaper roofing was torn and a 4" by 5" hole punched through one-inch-thick pine planks! Instantly they realized that whatever had ripped the hole in the garage roof, the car roof and the seat must still be there. Wheeling the car out of the garage and pulling out the seat, they found that beneath the seat the car's thick wooden floor boards were also smashed, and beneath these they could see a large dent in the top of the muffler, positioned directly beneath the hole in the floor.

Digging into the seat they found a blocky-shaped rock about the size of a softball. But the rock was so entangled in the coil springs of the seat they had to get a wirecutter to free it. Somehow they knew it just had to be a meteorite. The rock was taken to town and shown off in various business establishments; it was measured and weighed out at just about four pounds.

Apparently this stone meteorite had smashed first through the roof of the garage, then the roof of the car, then through the entire thickness of the upholstered seat where it became entangled in the coil springs. It then went on to punch a hole through the wooden floor boards and smash into the muffler beneath. The springs at this state, still tangled around the meteorite, jerked it back upward into the body of the seat, where it finally came to rest. It must have really been moving! Ed McCain was sobered by the thought of what would have happened had he been sitting in the car warming up the engine when it hit. He would never have known what hit him!

This was indeed a first in automotive history. Earlier, in the mid-1930s, there was a story of a car being similarly struck, somewhere in northern Indiana, but this turned out to be a false report.

As a matter of fact, incoming meteorites seem to favor targets that have to do with automobiles. In San Juan Capistrano, California (better known for the regular return of its swallows), on March 15, 1973, sometime between midnight and four a.m., a small stone meteorite smashed through the aluminum roof of a carport attached to a mobile home. This time there was no car parked inside, and the event went unnoticed until many hours later when the hole was seen in the carport roof and a walnut-size meteorite was found on the ground. About a month later a smaller piece of the same meteorite was found in a raingutter along the side of the carport roof.

On October 27 of the same year, another stone meteorite broke through the roof of a newly built garage in a residential neighborhood in Cañon City, Colorado. No one knew exactly when it fell, though it had to have been between 5:45 and 11:30 p.m. Again, no car was parked inside. This meteorite was especially interesting to scientists because the garage, being new, and the floor, with newly poured concrete, was free of oil spots, dirt, and other contaminants. This meant that studies of trace chemicals, found in the meteorite in minute amounts, could be analyzed without concern for contamination — a problem that does prevail with most meteorites that fall into soil.

On January 31, 1977, at 3:30 in the afternoon,

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*Edward Olsen is curator of mineralogy.*

four stone meteorites crashed into Louisville, Kentucky. Three of the pieces hit buildings, and one struck a parked automobile. The four pieces probably entered the upper atmosphere of the earth as a single object. When slowed down by the earth's atmosphere it often happens that stone meteorites are fractured into pieces that then fall together. In some spectacular cases a large stone meteorite can end up in hundreds of pieces of all sizes that rain down like buckshot.

Every year hundreds of millions of meteorites, most of them small bean-sized objects, enter Earth's upper atmosphere travelling at speeds up to 100,000 miles an hour. The vast majority of them burn away to fine dust. Only about 500 of tangible size survive to make it through to the surface. Seventy percent of these, of course, fall into the ocean, because that much of the earth is covered with oceans. This leaves only about 150 that could ever be recovered on land. Most of these fall in uninhabited places, forests, prairies, jungles, and mountains, and are never recovered. Those that fall on farmland have a chance of being recovered if farmers notice them during planting or harvesting operations. Indeed, most of the new meteorites that are reported each year are found by farmers and ranchers.

It's rather amazing that so few meteorites have landed in populated places and have done so little damage. From 1790 to 1954 only twenty-seven cases can be documented of meteorites striking buildings, and major cities have only rarely been struck. In more recent times, besides the one that landed in Louisville, in 1967 a small stone meteorite went through the roof of a warehouse in the northeastern outskirts of Denver. The exact time of its fall is not known because the first clue that anything was wrong came when it rained and someone saw that water was dripping through a hole in the warehouse roof.

Animals, as well as people, are smaller targets than buildings, so it isn't quite as odd that injuries and deaths, or even near misses, are rare. Only two cases of animals being hit are known.

At 12:45 in the afternoon of May, 1860, over south-central Ohio, the sky shook with explosive blasts. A very large meteorite was roaring in over the state in a northerly direction and was also heard over several adjacent states. It had broken into about 30 pieces that fell over an area of some 30 square miles, near the town of New Concord.

Nathaneal Hines was plowing his field at the time, when a piece, weighing 40–50 pounds, skim-

(*Continued on p. 26*)

*The late Henry W. Nichols, former curator of geology, views the Benld meteorite exhibit with visitor shortly after its installation in Hall 34 in 1939*

# The Legacy of Malvina Hoffman

On February 21, 1930, a handwritten note came to the registrar of Field Museum from the president of the Museum: "Please open a new a/c [account] on the books 'Hall of Physical Anthropology' & put Mr. Marshall Field's check to the credit of that a/c [signed] S. Field." That same month, a telegram to Malvina Hoffman, the New York sculptor, "Have proposition to make, do you care to consider it? Racial types to be modelled while traveling around the world," brought Miss Hoffman to Chicago and a meeting with Stanley Field and Field Museum's Board of Trustees.

The relationship established at this meeting lasted for many years and produced "The Races of Man," one of Field Museum's most famous exhibits, and Hoffman's most monumental work, 104 bronzes, revealing, as Hoffman wrote, "man to his brother."

*Malvina Hoffman with Stanley Field in the garden of Hoffman's Paris studio, ca. 1932. Field (1875-1964) was president of Field Museum from 1908 to 1964.*

The original plan of the project was worked out at the Museum. Hoffman wrote of the Board of the Museum, "a very alert and courageous group of men. To keep abreast of the times, they decided, after investigating the reasons why the anthropology halls in all countries were generally empty and the snake and monkey houses always crowded, to step out of the tradition and take a long chance. They felt that 'The Races of Man' should *look alive*, and be actual figures that anyone could recognize and feel to be authentic . . . so they decided to try sculpture. . . ."

Though the conception of the plan belonged to the Museum, the work was Hoffman's, and the final product bore the stamp not only of her artistic skill, but of her strong beliefs. The Museum had planned to hire four or five artists to go to various parts of the world. Hoffman pointed out that such an arrangement could not produce a consistent, balanced hall. She also pointed out the potential battles involved in four or five artistic temperaments. She won her point. She was commissioned alone to do the job.

Again, the original plan called for plaster figures. Hoffman felt strongly about this point: "I signed up for painted plaster, real hair and glass eyes, knowing absolutely that within six months this part of the contract would be changed without a struggle." She had two of the figures cast in bronze at her own expense in Paris and when Stanley Field saw them at her studio, that part of the contract was changed.

She spent the next several years traveling the world for the Museum, sketching and sculpting, and slowly assembling the exhibit. Hoffman had considerable skill in persuading normally shy people to pose for her. She was undaunted by primitive conditions, and overcame inevitable difficulties with

*Hoffman's Paris studio, with assistants Jean Limet (left) and his father.* Ca. *1932.*

great courage.

Only 80 percent completed, the Hall of Man opened on June 6, 1933, at the time of the opening of the International World's Fair in Chicago called the *Century of Progress.* More than 2,000,000 people visited the Hall in its first year, and countless millions more until 1967, when it was superseded, in Hall 3, by the Anniversary Exhibit, still to be seen there.

Many of the sculptures in the "Races of Man" series have continued in the ensuing years to be on view on the Museum's three exhibit floors; and now, six more full figures, a half-figure, and ten busts have been withdrawn from storage and added to those already on view. All splendid pieces are to be seen on the ground floor. The busts, in two groups, flank the west entrance; five of the full figures: *Hawaiian Surfer, Kashmiri Man, Caucasoid Man, Spear-thrower—Aborigine, Solomon Islander—Tree-climber,* and the half-figure, *Afghan Man,* may be seen in the hallways peripheral to James Simpson Theatre; the sixth full figure, *Jinrickshaw Man,* is located just north of the entrance to the central passenger elevator.

The "Races of Man" series, unique in the annals of both sculpture and anthropology, are a remarkable testament to the genius of Malvina Hoffman, who died in 1966 at the age of 81.

# The Art of Malvina Hoffman

## *Additional Pieces Now on View on Ground Floor*

*Caucasoid Man*

*Spear-thrower, Aborigine*

*Kashmiri Man*

*Solomon Islander—Tree-climber*

*Jinrickshaw Man*

*Afghan Man*

*Hawaiian Surfer*

*Near Bolivia's Lake Titicaca lie the ruins of the prehistoric city of Tiahuanaco. Dominating it is this massive, stone-faced platform mound, Akapana, 656 feet on a side and nearly 50 feet high.*

Michael Moseley, copyright © National Geographic Society

# Archaeology At the Top Of the World

By Alan L. Kolata

In the year 1549, while travelling around the shores of Lake Titicaca in the high Andes of present-day Bolivia, the Spanish soldier and chronicler Pedro Cieza de León came upon the remnants of a great city whose stones even then were worn with age and tumbled into ruins. In recording his impressions of this encounter, Cieza provided the first written account of the ancient archaeological site of Tiahuanaco (or Tiwanaku as it is now called in Bolivia). He noted that Tiahuanaco was "famous for its great buildings which, without question, are a remarkable thing to behold," and described one of them as a man-made hill built upon massive stone foundations. Cieza was even more impressed by the enormous stone idols carved in human form which were set within the monumental structures of this mysterious ruined city. He wrote that these sculptures of stone were so large, "they seem small giants," and so beautifully carved, "they seem the work of great artists or masters."

Ever since Cieza's initial account, Tiahuanaco has exercised an extraordinary hold over the imagination of scholars and the general public alike. The city and its monuments have been the subject of numerous descriptive studies, as well as speculative interpretations that purport to decipher the meanings encoded in its stone sculptures. For instance, the famous "Gateway of the Sun," a stunning ceremonial portal carved from a single andesite block, has inspired a host of ingenious, but incredible, interpretations. Common to fanciful reconstructions of the gateway's symbolic content is the belief that this monument records events from a profoundly distant past. One such interpretation makes the astonishing claim that the Gateway of the Sun is an astronomical document in stone that records the eclipses, equinoxes, solstices, and peculiar cosmic geometry of a "pre-lunar" world of unfathomable antiquity, perhaps hundreds of thousands of years old. Another not only ascribes to Tiahuanaco (and the gateway) a similarly fantastic "geological date," but also attributes the city's immense cut-stone architecture and sculpture to some creative, laser-wielding extraterrestrials!

Michael Moseley, copyright © National Geographic Society

*Carved stone head tenoned into the west wall of the semisubterranean temple at Tiahuanaco.*

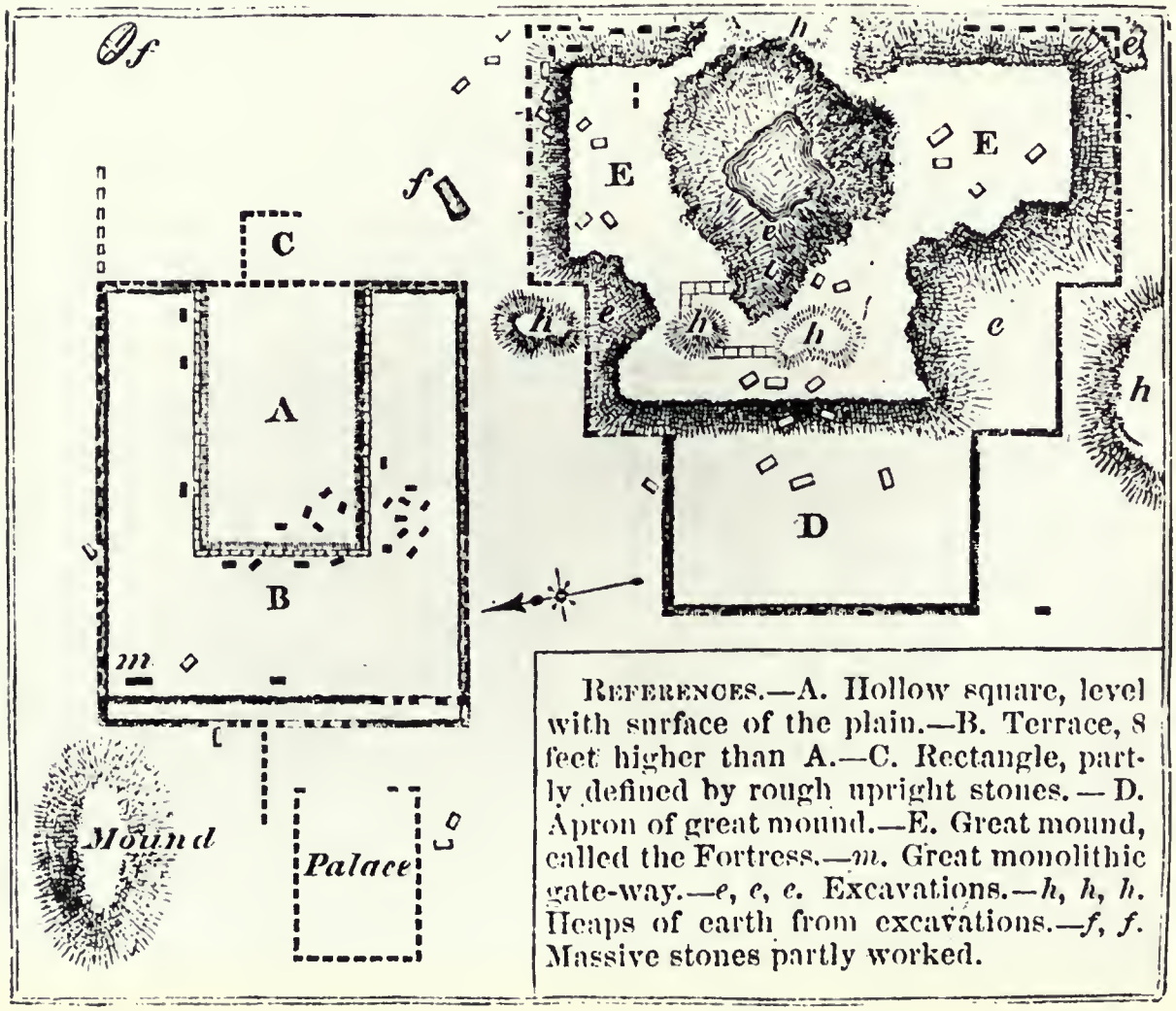
*Alan L. Kolata is a Field Museum research associate.*

Perhaps more than any other archaeological site in native America, Tiahuanaco has suffered from this kind of latter-day mythologizing and flights of speculative fancy. Part of the reason for this can be attributed to the unique environmental location of the city. The ruins of Tiahuanaco are situated near the southern shore of Lake Titicaca in an overpowering landscape of high steppe (or *altiplano*) and rugged, snow-shrouded mountains. The long, relatively narrow valley in which this ancient urban center evolved is set at an altitude of 3,850 meters, or some 12,600 feet. This extreme elevation gives Tiahuanaco the distinction of being the highest urban settlement of the ancient world and, together with the surrounding mountain peaks — some of the tallest in the Andean chain — imparts to the city an exceptional aura. The panoramic windswept vistas opening out from the site towards the lake and the mountains make it clear that the dramatic setting of the city has contributed greatly to the myths, legends, and fantasies that have been built up around Tiahuanaco through the centuries.

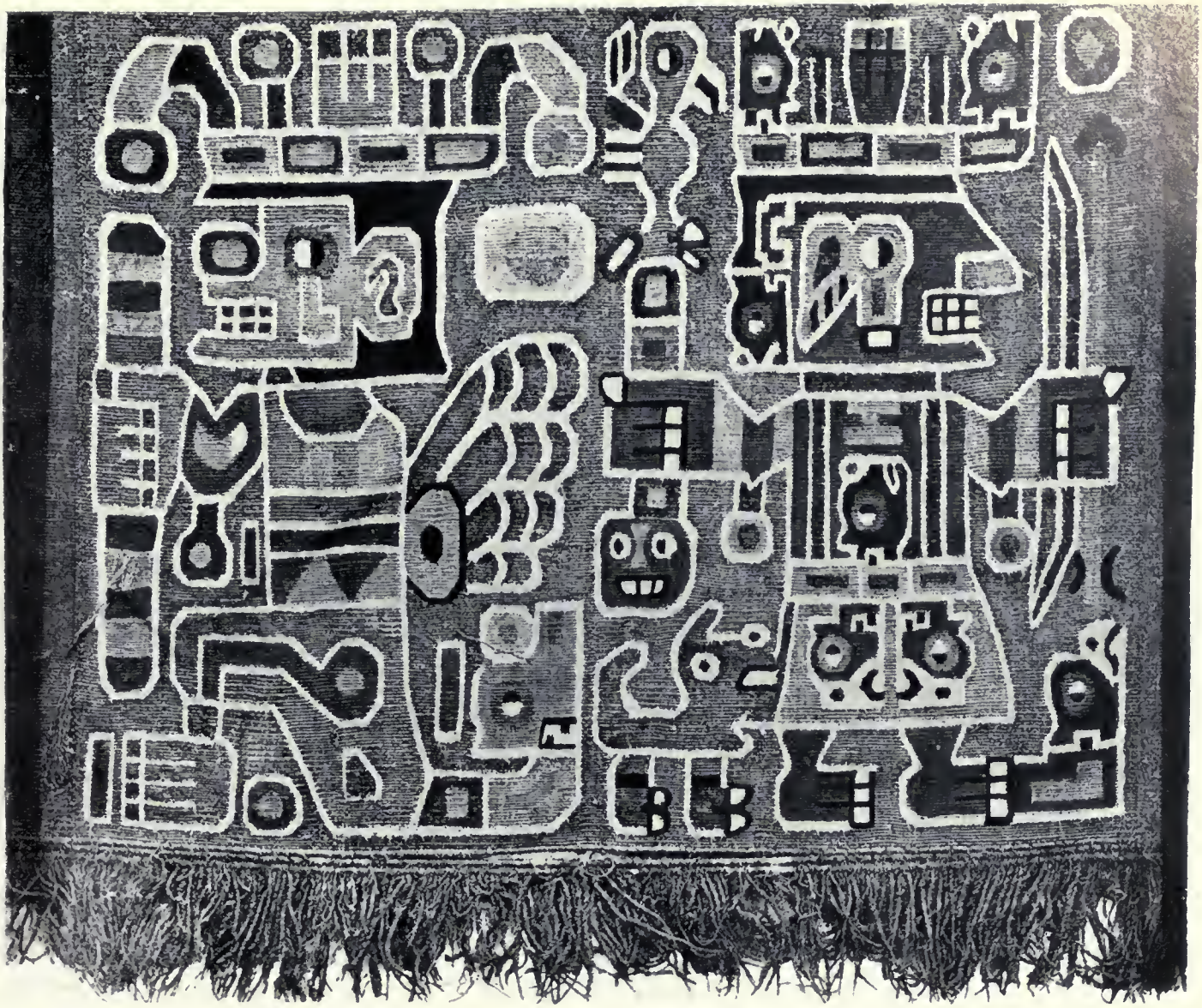
However, the single most important factor that has encouraged speculation grounded in fancy instead of fact is the relatively small amount of scientific research that has been conducted at the site. Apart from some sporadic instances of controlled archaeological excavation carried out in the first half of this century, it was not until the late 1950s that a continuing program of systematic research was initiated by Bolivia's Instituto Nacional de Arqueologia (INAR). This research has established that Tiahuanaco was the focus of a long and complex history of human occupation between about 1500 B.C. and A.D. 1200, and has outlived five major phases of habitation spanning the period between 250 B.C. and A.D. 1000. INAR archaeologists are continuing to probe Tiahuanaco's complicated past, gradually isolating the city's many architectural and cultural components.

Although INAR investigators have unearthed cultural remains such as ceramics at Tiahuanaco that date back as far as 1500 B.C., the city was most densely occupied and exerted its greatest influence in the Andean world during the period of about A.D. 500-1000. Because of a widespread supplanting of other regional art styles by the distinctive style of Tiahuanaco during this time, most archaeologists believe that this "influence" took the form of a pan-Andean empire. If this is correct, Tiahuanaco at one time was the capital of an imperial realm that incorporated into its domain the vast mountain territories of Peru, Bolivia, and Argentina, as well as the arid lands strung along the Pacific coasts of Chile and Peru.

More recently, Andeanists have recognized that the inhabitants of a second archaeological site, the urban settlement of Huari near the modern town of Ayacucho in the highlands of southern Peru, adopted many of the symbols and stylistic conventions of Tiahuanaco art in the sixth century. From the sixth to the ninth century, Huari was instrumental in spreading its interpretation of the Tiahuanaco style, and presumably the religious doctrines and social beliefs embodied in this style, throughout the highland and coast of Peru.




*Map of part of the ruins of Tiahuanaco published by the great late 19th-century explorer of the Andes, Ephraim George Squier. After Squier, 1877.*



*Remarkably well preserved textile fragment unearthed at the Necropolis of Ancon, an ancient archaeological site near Lima, on Peru's central coast. The figures in the design are virtually identical to ones carved in stone on the Gateway of the Sun at Tiahuanaco. This textile is a splendid example of provincial Tiahuanaco art. After Stübel and Uhle, 1892.*

*Portal to Catholic Church in village of Tiwanaku, shown in 1876. Many stones in the church's structure were taken from the nearby archaeological site. The two statues flanking the portal continue to guard it today. After Stübel and Uhle, 1892.*

Above: *The Gateway of the Sun, restored and placed on foundations in 1908. After Posnansky, 1945.*

Left: *Detail of the central figure carved on the Gateway of the Sun. Figure may have been an emblem of Tiwanaco's ruling elite. After Stübel and Uhle, 1892.*

Below: *Detail from the Gateway of the Sun. One of the elaborately attired, winged attendants that face the central figure shown in left photo. After Stübel and Uhle, 1892.*

Alan Kolata, copyright © National Geographic Society

The precise nature of the relationship between Huari and Tiahuanaco remains obscure. But it is likely that neither city held hegemony over the other, and that Huari and Tiahuanaco functioned as autonomous "dual capitals" of the imperial realm, controlling the northern and southern regions of the empire respectively. This type of political arrangement is not without precedent in the history of empires: the east-west division of the late Roman Empire with capitals at Constantinople and Rome is a classic example.

We do know that the empire of Tiahuanaco had a lasting cultural impact in the ancient Andean world. Spanish chronicles relate that the Inca, some 500 years after the disintegration of the empire, looked to imperial Tiahuanaco as their cultural progenitor. Several chroniclers note that the Inca believed their origins to lie in the region of Lake Titicaca, and that the Inca kings, in particular, claimed descent from a "great creator" who lived at Tiahuanaco. By tracing royal descent from the ancient inhabitants of Tiahuanaco, the Inca monarchs were claiming their inalienable right to forge and rule their own imperial realm.

The monumental scale and considerable elaboration of the architecture at Tiahuanaco befits its status as an imperial capital. The city is dominated by two massive, stone-faced platform mounds: Akapana, the largest structure at Tiahuanaco, measuring some 200 m (656 feet) on a side and over 15 m (49 feet) high, and Pumapunku, a smaller terraced mound (150 m, or 492 feet, on a side and about 5 m, or 16 feet, high) built of the finest andesite and sandstone block masonry to be found in the city. Recently INAR opened a 20-meter

*These huge megalithic andesite and sandstone blocks once formed the entrance to Pumapunku. Over the centuries, looters in search of treasure have mined underneath the blocks, causing their collapse. Some, weighing over 100 tons, were quarried more than six miles away.*

Michael Moseley, copyright © National Geographic Society

*Detail of the "Ponce Monolith." This colossal carved stone statue was discovered by archaeologists with Bolivia's Instituto Nacional de Arqueologia just inside the entrance to Kalasasaya, the principal temple at Tiahuanaco.*

*Arthur Posnansky, engineer turned archaeologist, shown in 1903 while exploring the ruins of Tiahuanaco. He poses with* El Fraile *("The Friar"), one of the great monolithic effigies found in the Kalasasaya. After Posnansky, 1945.*

(66-foot) wide excavation on the east side of Akapana revealing that the exterior of the mound is terraced, consisting of three mammoth stone-faced retaining walls set above and behind each other in step-wise fashion. Cieza's description of a man-made hill built upon massive stone foundations is surely a reference to this imposing feature of the Akapana.

Other important structures at Tiahuanaco include the semisubterranean temple and Kalasasaya, a large rectangular precinct whose walls were built of towering rough-cut sandstone pillars alternating with sections of smaller, rectangular blocks of high quality masonry. Both of these structures are adjacent to the north face of Akapana.

Cieza's view of the architecture at Tiahuanaco 430 years ago was without doubt more complete than ours today. Since the Spanish conquest, innumerable stones of the city have been torn from their original context and reused in the construction of churches, private houses, and the roadbed of the railroad that runs through the site to the village of Huaqui on Lake Titicaca. Yet, despite the devastation wrought by looters over the centuries, enough architecture remains intact to enable us to identify structures that fulfilled various religious, administrative, and residential functions. For example, abutting Kalasasaya is a building complex constructed of superbly cut hardstone ashlars (square building stones) that has been interpreted as a palace compound—a residence of the elite who ruled from Tiahuanaco.

Set within the ritual and administrative structures of the city—the palaces, temples, and pyramidal mounds—were some of the finest stone sculptures of ancient America. Perhaps the most famous of these are the megalithic ceremonial gateways that provided access to the sacred precincts of the city. Pumapunku, Akapana, and Kalasasaya were all furnished with impressive stone portals embellished with friezes carved in low relief. The largest and iconographically most complex portal, the Gateway of the Sun, was erected in the northwest corner of Kalasasaya. The frieze on this gateway depicts a central figure dressed in an elaborate tunic standing on a triple-terraced platform mound and holding two scepters that end in condor heads. Flanking this figure and facing him are arrayed six rows of elegantly sculptured winged attendants who each carry the condor-scepter.

The central figure of the frieze may portray the paramount deity of Tiahuanaco's pantheon. An important, elaborately costumed deity holding two scepters or staffs first appeared in Peru during the Chavín horizon (*ca.* 1200–300 B.C.). During Tiahuanaco's imperium, this "staff god," as it appears carved on the Gateway of the Sun, was introduced throughout the Andean world, clearly reflecting the expansion of the empire's political power and ideological prestige. In this regard, it is possible that the central figure of the gateway was intended to be an emblem of Tiahuanaco's ruling elite, or perhaps even the portrait of a god-king. The specific identity and meaning of the gateway figure remains lost in antiquity.

Other sculptures, carved in the form of free-standing monoliths ranging from 1.5 to 7.6 m (5 to 25 feet) in height, were erected at Tiahuanaco. Some of these monoliths remain *in situ* in Kalasasaya and the semisubterranean temple. These colossal monuments, portraying human figures wearing costumes like that of the gateway figure and holding scepters, goblets, and other ritual equipment, were the primary cult effigies of Tiahuanaco and an important focus of its active religious and civic life.

Stone stelae and plaques incorporated in the walls of royal residences and religious structures were employed as ornaments and as objects of ritual display. Some of these wall plaques were heraldic devices featuring powerful opposed animal figures such as stylized pumas, condors, or mythical composite beasts. Stone tenon heads depicting naturalistic human faces, skulls, and gargoyles were another form of architectural ornament.

The entire range of figurative representations in the monumental art of the imperial capital appears in smaller-scale, portable objects that were produced and exchanged throughout Tiahuanaco's imperial realm. Human figures holding scepters and other ritual paraphernalia, winged attendants, highly stylized pumas, condors, and griffins were all directly transposed into a variety of media: precious metals fashioned into royal crowns, jewelry, pectorals, and emblematic plaques; vivid textiles used as tapestries, mantles, and costumes; fine-grained wood and stone carved into portrait heads, bowls, beakers, and weapons; exquisitely modeled, polished and finely painted ceramics executed in a bewildering array of forms and sizes. These portable masterpieces of Tiahuanaco art, in reproducing with perfect fidelity the fundamental iconographic themes carved in the monumental sculptures of the capital, visually communicated the unifying power of this Andean empire.

During the summer of 1978, Field Museum, with the financial support of the Tiwanaku Archaeological Foundation (a private organization established for the purpose of furthering research and development of Bolivia's cultural resources, particularly in the archaeological zone of Tiahuanaco), initiated a preliminary research program designed to complement the ongoing efforts of INAR at Tiahuanaco and its environs. Our research was intended to aid Bolivian investigators in locating areas of the city that would be likely to yield important cultural remains upon excavation.

Large and exceptionally complex ancient settlements such as Tiahuanaco cannot be completely excavated. They are explored by means of sample excavations that uncover only a small percentage of the prehistoric remains. By employing sophisticated techniques of geophysical prospecting, we have been able to increase the efficiency of excavation strategies at Tiahuanaco through foreknowledge of what is likely to be encountered in specific areas of the settlement. (For another archaeological application of these techniques by Field Museum investigators see "Archaeology in the Electronics Age," July/August 1978 *Bulletin*.)

At Tiahuanaco we used two prospecting devices provided by Soiltest, Inc. of Evanston, Ill.: a portable seismograph and a proton magnetometer. The seismograph measures the velocity at which a shock wave travels through the earth; the magnetometer measures the local magnetic field of the earth. Both seismic velocity and intensity of the

Michael Moseley, copyright © National Geographic Society

*Ridged or drained fields near Lake Titicaca's southern shore. These agricultural fields may have been a major component in Tiahuanaco's sustaining economic system. They will be one focus of future attempts to reconstruct the city's economic life.*

local magnetic field are dependent upon the types of subsurface materials that are present in the area being explored. For instance, the characteristic seismic velocity and magnetic field of loose soil are generally very different from that of hard, dense stone. Since much of the monumental architecture and sculpture at Tiahuanaco was made of stone, these instruments used in tandem made it possible for us to readily detect, map, and calculate the depth to subsurface "anomalies" that represent significant archaeological features.

For example, a 10-square-meter section of the southeast corner of Akapana's summit registered some intense magnetic anomaly readings. A seismic transect of this section indicated that the anomaly had a high velocity characteristic of hard stone, and was located at a depth of approximately one meter. A subsequent test pit in the area uncovered the remnants of a subterranean, stone-lined drainage system. We recorded a number of other intense anomaly readings in the area between the Akapana and Kalasasaya, and on the summit of Pumapunku. When INAR opens excavations in these areas, it is likely that some previously undetected, major archaeological features such as large architectural blocks or perhaps even new stone sculptures will be brought to light.

In the future, we intend to expand our research program at Tiahuanaco to include an analysis of the city's sustaining economic system. Archaeologists have often interpreted Tiahuanaco simply as a ceremonial center: the focus of periodic pilgrimages from throughout the southern Andes, but lacking a substantial resident population. This interpretation of Tiahuanaco resulted from considering only the impressive monumental architecture: Akapana, Pumapunku, and Kalasasaya. However, recent work has shown that the total occupation area of the settlement, including both public *and* residential architecture, exceeds four square kilometers, implying a much larger permanent population than had been suspected.

To feed this population, Tiahuanaco must have maintained an extensive agricultural system. Immense tracts of now abandoned agricultural fields survive around Lake Titicaca's southern shore. These fields consist of artificially constructed platforms or ridges that were designed to drain planting surfaces in order to permit cultivation. It is possible that these "drained fields" were constructed very early in the history of Tiahuanaco and, as the state expanded its imperial realm, became vast agricultural estates, chiefly responsible for supporting its growing urban population. We will be testing this and similar propositions, as we try to reconstruct the economic foundations of this spectacular city that evolved high in the mountains of Bolivia, at the top of the Andean world.

# Edward E. Ayer Film Lecture Series

## Mid-October through Mid-November

**James Simpson Theatre**
***Saturdays, 2:30 p.m.***

The entrance to Simpson Theatre is conveniently located just inside the Museum's west entrance. This is of special interest to the handicapped, for the west entrance is at ground level and all steps between curbside and theatre have been eliminated. The west entrance also provides free admission to the theatre. Access to other Museum areas, however, requires the regular admission fee (except on Fridays) or membership identification. Plan to have dinner in the Museum's dining area before attending the lectures.

The illustrated lectures are approximately 90 minutes long and recommended for adults. Reserved seating is available, until 2:25, for members and their families. Door open at 1:45 p.m.

*Venice canal, from Phil Walker's "Northern Italy and Rome," showing Oct.27.*

**OCTOBER 20**

*"Sri Lanka"* Presented by Ralph Gerstle

Gerstle's camera captures the variety of Sri Lanka—lush scenery, exotic wildlife, and tea plantations in airy mountain settings. The ancient capital cities boast towering Buddhas carved into vertical granite cliffs. Giant reservoirs built by the ancient Ceylonese are engineering marvels still in use today. Work elephants haul massive loads with great skill—the bulldozers of contemporary Sri Lanka. A film that transports the viewer to a land as beautiful as the precious gems found there.

**OCTOBER 27**

*"Northern Italy and Rome"* Presented by Phil Walker

Lecturer Philip Walker has subtitled his film "The Italy of Leonardo da Vinci." A pictorial essay on the life and work of this incomparable genius, the film show da Vinci's birthplace, his masterpieces in oil and marble, and models of his futuristic inventions. Cross references are made to the works of Michelangelo, Botticelli, and Raphael. Views of the Roman Forum, the Coliseum, the Grand Canal, and the Bridge of Sighs are woven together with scenes of flea markets and vineyards to create a living tapestry of Leonardo's homeland.

**NOVEMBER 3**

*"Denmark and Greenland"* Presented by Arthur Wilson

Wilson takes us first to Denmark, where we visit Copenhagen, the beauty of Tivoli Gardens, and the charm of South Jutland. From there we journey to the vast expanses of Greenland. We view the contrasts of mountains of ice crashing into the sea and the delicacy of arctic flowers and spectacular scenery. Scenes include wild caribou, grazing sheep, and shrimp factories.

**NOVEMBER 10**

*"Mark Twain in Switzerland"* Presented by Dick Reddy

In 1878 Mark Twain set sail for Switzerland to experience firsthand its frozen beauty and magnificent mountains. Filmmaker Dick Reddy retraces Twain's route—over the Brunig Pass, up the jutting Matterhorn, and to the dungeons of the Castle of Chillon.

*Danish chimneysweep, from Arthur Wilson's "Denmark and Greenland," showing Nov. 3.*

*Con't from p. 11*

med past him, missed his plowhorse's head by a few feet, and plopped to earth only 500 feet away. Not much further off it was reported that a colt was actually struck and killed.

And, on June 28, 1911, near the village of Nakhla, Egypt (about 24 miles east of Alexandria), the morning sky was similarly shaken as 40 pieces of stone meteorite pelted the ground, one killing a dog.

When human habitations have been struck there is of course a possibility of injury or death to a person if the meteorite is large enough. In Hamlet, Indiana, in 1959, a stone meteorite narrowly missed going through the roof of the house of the Hall family. Instead, it merely clipped off the raingutter. In Wethersfield, Connecticut, in 1971, a small stone meteorite actually went through the roof of the Paul Cassarino home. The meteorite must not have been going very fast because it only went through the roof and didn't have enough force left to pierce the ceiling below. It was discovered in the attic.

The most famous case in meteorite lore of a narrow escape by a person occurred at 1 p.m. on November 30, 1954, just northwest of the small town of Sylacauga, Alabama. Mrs. E. Hulitt Hodges had just finished lunch and settled herself down to take a short nap. She was soon jolted awake, however, and leaped out of bed as she heard a violent crash. Thinking the gas heater in the room had exploded she looked around and saw a "rock" lying on the floor. Then she felt a deep pain in her left arm and hip. The rock was a 12-pound stone meteorite that had smashed through the 3/4"thick wooden roof, grazed the rafter, punched through the 3/4" ceiling boards, hit a radio in the room below, glanced off and ended its flight by smacking Mrs. Hodges along her left side through the thickness of two quilts! She was hospitalized briefly, mostly to recover from the shock. Mrs. Hodges was lucky to come off with only bruises.

At the present time, with the known influx of meteorites, and the world population at its current level, the chances are that one person could be hit by an incoming meteorite about ever 4,500 years! Of course, as the population increases, and larger portions of the land become covered by towns and cities, the chance becomes greater and greater. Even at that, death or injury by a falling meteorite will probably never be considered a major hazard to life.

Some large objects, asteroids with dimensions measured in thousands of feet, up to a mile or more, pass the earth very closely. For example, in 1937 the asteroid Hermes passed the earth at a distance of a mere 465,000 miles. In terms of space, this was a close call. Hermes and related bodies are in orbits that cross the earth's orbit. In time, there is a chance such a body could actually hit the earth. We know that large meteorites have stuck earth before because we can still see some of the craters, of huge sizes, that they created. One such impact, centering on a major metropolitan area, could constitute the greatest natural disaster on record, rivaling the largest earthquake catastrophes of history.

As time goes on, more automobiles will probably be struck by incoming meteorites, but that solid old 1928 Pontiac will hold the honor — such as it is — of surviving the first such blow. It could still be driven away under its own power. They really built cars in those days! We can wonder what would happen if a present-day model were ever hit. □

*The "Morito" meteorite, shown in Chihuahua School of Mines, Mexico, about 1900.*

# October & November at Field Museum

*(October 15 through November 15)*

### New Exhibit

**"The Place for Wonder."** Find out about the new feature in "The People Center": "touchable" items from the People's Republic of China. You can try on a bamboo backpack, ceremonial costumes, or contemporary jewelry. Other touchable items include musical instruments, incense burners, and puppets used in religious festivities. All of this and more is available in the Place for Wonder, the ground floor gallery where children and adults alike may handle what they see. The exhibits include examples from the Museum's four disciplines: geology, botany, zoology, and anthropology. The exhibit is also equipped with text in braille. Weekdays 1:00-3:00 p.m.; weekends 10:00 a.m. to noon and 1:00-3:00 p.m.

### Continuing Exhibits

**"Art Lacquer of Japan."** The Museum's newest permanent exhibit features more than 400 objects of exquisite lacquer art from 18th- and 19th-century Japan. The objects on display include finely carved and decorated *inro* (small sectional lacquer cases used to carry medicine), *ojime* beads, and *netsuke* (miniature carved pendants hung from silk cords). These objects were worn by Japanese men as symbols of wealth and status. Hall 32, second floor.

**"A Stamp Sampler: Postage from Natural History."** A one-case exhibit that combines 63 natural history specimens with samples of philatelic, or stamp, art. Planned on a rotating basis to cover the four disciplines of natural history, the exhibit in its first phase is devoted to zoological specimens and their images on stamps. Exquisite seashells, butterflies, a leaping jaguar, and fox are among the specimens mounted in the second floor lounge. "A Stamp Sampler" was conceived by Col. M. E. Rada, exhibit guest curator, and designed by Peter Ho, a University of Illinois graduate student.

**"Hall of Chinese Jades."** The Hall of Chinese Jades contains examples of beautiful jade art spanning over 6,000 years of Chinese history. An exhibit in the center of the hall illustrates ancient jade-carving techniques. Hall 30, second floor.

### New Programs

**Learning Museum Program.** During October, Field Museum is inaugurating a three-year sequence of learning opportunities centered around the Museum's outstanding exhibits and collections. All the units of study will consist of special events, lectures, and seminars. The entire Learning Museum Program is being funded by the National Endowment for the Humanities. The first course, "China: A Deeper Look," is an in-depth examination of this multi-faceted culture. Explore the historic origins of Chinese civilization and its development through the ages. Phone 922-9410, ext. 395, for more information.

"Aspects of Peking Opera." Performed by Hu Hung-yen, the only professional actress of Peking Opera living in the United States. Accompanied by two musicians wearing elaborate costumes, she performs traditional opera selections. This program is one of the special events of the Learning Museum Program. Friday, Oct. 19, at 8:00 p.m. James Simpson Theatre, West Entrance. Members $3.00; nonmembers, $5.00.

**Kroc Environmental Lecture.** "A New Look at Nature." Filmed by Oxford Scientific Films and presented in person by Dr. John Paling. New sequences show how nature and man can affect the ways of birds, bees, mice, and the freshwater creatures of Australia. Paling will give a behind-the-scenes account of how he and his award-winning colleagues made this 90-minute film. Friday, Nov. 9, at 8:00 p.m. A Members' dinner will precede the film at 6:30 p.m.

*Dr. John Paling, shown with orphaned squirrel, presents Kroc Environmental Lecture November 9.*

**Weekend Discovery Programs.** (Fall 1979 series) Free guided tours, demonstrations, and participatory events. Check weekend sheet available at North Information Booth for additional programs and locations.

"Kalvak." Half-hour film about a Canadian Eskimo who has painted and sketched since the late 1950s. The film explores what happens when a majority culture with its own ideas and economics of art impinges on a minority of a very different tradition. Saturday, Oct. 20, at 1:00 p.m.

"Ancient Art of Spinning." Demonstrations and talk on history and development of spinning in several cultures. Sunday, Oct. 21, 12:30 p.m. to 2 p.m.

*(Continued on back cover)*

# October & November at Field Museum

*(Continued from inside back cover)*

**Weekend Discovery Programs**

"Ancient Egypt." 45-minute tour explores the traditions of ancient Egypt, from everyday life to myths and mummies. Meet at North Information Booth. Saturday, Oct. 27, at 11:30 a.m.

"The Hands of Maria." A film showing how Maria Martinez and her husband began to revive and extend the pueblo pottery traditions of San Ildefonso, New Mexico. Watch Maria shape a dish, her son paint it, and Maria fire it in an old-fashioned open kiln. Saturday, Oct. 27, at 1:00 p.m.

"The Legend of the Magic Knives." A twenty-minute film. The Kwakiutl Indians of British Columbia extolled family prestige and tradition. Watch as artist Tony Hunt enshrines a carver's story in a cedar log while the legend is dramatized by masks made by Hunt and his predecessors. Saturday, Oct. 27, at 1:10 p.m.

"China Through the Ages." Rare turn-of-the-century lantern slides are featured in this look at traditional China. Saturday, Oct. 27, at 1:30 p.m.

"Culture and History of Ancient Egypt." Orientation film precedes 45-minute tour of ancient Egyptian artifacts; tour concludes with description of mummification process. Sunday, Oct. 28, at 12:30 p.m.

"The Inside Story: Some Adaptations of the Bones and Teeth of Mammals." Looks at changes in teeth and bones that characterize the variation in today's mammals from runners to swimmers to flyers: and from grass-eaters to meat-eaters. Sunday, Oct. 28, at 1:30 p.m.

"Early Man." Half-hour tour traces major trends in the physical and cultural evolution of man. Saturday, Nov. 3, 11:30 a.m.

"Yesterday's Pots Today." One-hour demonstration of basic pottery-making techniques from many cultures. Saturday, Nov. 3, 11:00 a.m. to 12 noon.

"Clay Dinosaurs." Make a clay dinosaur to take home while learning about dinosaurs and their habitats. Sunday, Nov. 4, 11:00 a.m. to 1:00 p.m.

"What Ecologists Do." (15-minute film) Ecologists are scientists who study problems related to how living things act or depend upon one another. Saturday, Nov. 10, 1:00 p.m.

"Ecological Systems . . . . Antarctica." (13-minute film) Basic features of our coldest continent show an ecologically undisturbed setting. Saturday, Nov. 10, 1:00 p.m.

"Culture and History of Ancient Egypt." 45-minute tour on Field Museum collection of ancient Egyptian artifacts; tour concludes with description of mummification process. Meet at North Information Booth at 1:00 p.m. Sunday, Nov. 11, 1:00 p.m.

**Edward E. Ayer Film Lectures** are scheduled every Saturday afternoon in October and November at 2:30 p.m. James Simpson Theatre. Reserved seating is available for Members and their families. Doors open at 1:45. For further information see page 25.

| | |
|---|---|
| Oct. 20 | "Sri Lanka—Resplendent Ceylon"<br>*By Ralph Gerstle* |
| Oct. 27 | "North Italy and Rome—The Italy of Leonardo da Vinci"<br>*By Philip Walker* |
| Nov. 3 | "Denmark and Greenland"<br>*By Arthur Wilson* |
| Nov. 10 | "Mark Twain in Switzerland"<br>*By Dick Reddy* |

**Fall Journey:** "Creatures of the Night." Self-guiding tour takes you to another world—a world of darkness. Many forms of North American wildlife are nocturnal. Although numerous, they are hidden by the darkness of night. Learn how these "invisible" animals live and thrive—as creatures of the night. Free *Journey* pamphlets available at the North Information Booth and at the South and West Doors.

**Continuing Programs**

**"The Ancient Art of Weaving."** Learn about age-old weaving techniques and textile development during these free demonstrations. Monday, Wednesday, and Friday from 10:00 a.m. to noon. South Lounge, second floor.

**Friend or Foe? The Natural History Game.** The object here is to determine which one of apparently similar specimens is harmful and which is not. See if you can distinguish a vampire bat, a headhunter's axe, a poisonous mineral, or a deadly mushroom from its benign look-alike. Ground floor, no closing date.

**On Your Own at Field Museum.** Self-guided tour booklets, adult-and-family-oriented, are available for 25¢ each at the entrance to the Museum Shop, main floor north.

**Volunteer Opportunities.** Limited opportunities available in botany, geology, and zoology. Weekend volunteers with an interest in natural history are needed to develop and present weekend programs. For more information call 922-9410, ext. 360.

**October and November Hours.** The Museum is open daily from 9 a.m. to 5 p.m. through October; to 4 p.m. beginning November 1, every day except Friday. On Fridays the Museum remains open throughout the year until 9 p.m.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at the reception desk, main floor.

November
1979

# FIELD MUSEUM OF NATURAL HISTORY BULLETIN

# Field Museum of Natural History Bulletin

November, 1979
Vol. 50, No. 10

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*Production:* Martha Poulter
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## Field Museum of Natural History

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*President and Director:* E. Leland Webber

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*Large figurine, Japanese; from Latest Jomon Period (1,000-300 B.C.). Aomori Prefecture, northernmost Honshu. Photo courtesy the University of British Columbia Museum of Anthropology. This figurine, together with more than 100 other artifacts of prehistoric Japan will be on view in Hall 27 from December 1 through January 31.* *See page 4.*

# FIELD BRIEFS

### National Science Foundation Awards $344,933 in Grants

The National Science Foundation (NSF) has awarded grants in support of five research and collection areas: (1) $182,676 in support of the fossil vertebrate collection; co-principal investigators are William D. Turnbull, curator of fossil mammals, and John R. Bolt, associate curator of fossil reptiles and amphibians. (2) $52,080 in support of the project, "The Care and Use of Systematic Collections of Insects"; project director is Rupert L. Wenzel, curator and head, Division of Insects. (3) $5,875 for acquisition of equipment to improve the scanning electron microscope facility of the Museum's Advanced Technology Laboratory; project director is John R. Bolt. (4) $38,579 for continued support of the project, "Preventive and Technical Conservation of Textiles"; Phillip H. Lewis, chairman of the Department of Anthropology, is principal investigator and project director. (5) $65,723 for support of research in "Pollen Morphology and Evolution in the Santalales, an Order of Parasitic Flowering Plants"; Sylvia M. Feuer, research associate, is principal investigator.


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I certify that the statements made by me above are correct and complete. — *Norman W. Nelson, asst. dir., admin.*


### NEH, HEW, Illinois Arts Council Grants

The National Endowment for the Humanities has awarded a $29,059 grant for support of planning the project "Tiahuanaco: Art and Empire in the Andes," a major travelling exhibition interpreting the art and culture of this ancient empire of South America (1500 B.C.-A.D. 1500). Project director is Michael E. Moseley, associate curator of Middle and South American archaeology and ethnology.

The Department of Health, Education, and Welfare has awarded $57,920 for support of the project "Living New World Monkeys (Platyrrhini) Volume 2." Project director is Philip Hershkovitz, curator emeritus of mammals. This is the first increment of a projected three-year grant that will total $171,810.

The Illinois Arts Council has awarded Field Museum $20,000 for support of the Museum's arts-related programs for 1979-80. Program director is Carolyn Blackmon, chairman of the Department of Education.

### James L. Palmer, Remick McDowell

Field Museum suffered a grievous loss through the deaths, within one month, of two Life Trustees and former presidents, James L. Palmer and Remick McDowell.

James L. Palmer, president of Field Museum 1964 to 1969, died September 17; he was 80 years of age. Palmer had been elected a member of the Board of Trustees in 1963 and was Life Trustee at the time of his death.

During Mr. Palmer's term as president the Museum began its first corporate and individual annual contributors' campaign; the Women's Board was founded, and a number of very successful temporary exhibitions were mounted. It was during James Palmer's tenure that the Museum began its 75th anniversary celebration by returning to the name by which it had so long been known — Field Museum of Natural History.

A native of Waterboro, Maine, Mr. Palmer came to Chicago in 1919. He received a graduate degree from the University of Chicago in 1922, then served on the university faculty for 14 years. He was named director of sales for Marshall Field & Co. in 1937 and became vice president of the company, a position he held until 1964.

Remick McDowell, president of Field Museum from 1969 to 1974 (succeeding James Palmer), died September 29 in Sarasota, Florida, at 70 years of age. He had been elected a member of the Field Museum Board of Trustees in 1965 and was a Life Trustee at the time of his death.

Mr. McDowell's contribution to Field Museum was enormous. During his term of office, plans for the massive building renovation were begun; the $25 million capital campaign was planned and completed, and the Board of Trustees was reorganized to provide a much stronger policy-making and management structure.

A native of Chicago, Remick McDowell attended Northwestern University and the University of Chicago, where he received his MBA degree. He worked for Peoples Gas Company for 34 years, serving as chairman of the Board and chief executive officer from 1961 to 1974.

Field Museum and the millions that it serves owe much to these two devoted and energetic civic leaders, each of whom contributed greatly to the business and philanthropic life of Chicago and who led the Museum during a pivotal, transitional decade in its history.

*Remick McDowell*

*James L. Palmer*

# IMAGE AND LIFE

## 50,000 Years of Japanese Prehistory

Opening December 1: An exhibition of artifacts of the Palaeolithic, Jomon, Yayoi, and Kofun periods from Japanese collections.

This exhibit of more than 100 artifacts, on view in Hall 27 until January 31, includes weapons, household and agricultural tools, pottery, figurines, jewelry, and other art objects; some of these extraordinary pieces are between 50,000 and 70,000 years old. The exhibit's current tour is the first appearance of any of the pieces outside Japan.

Organizers of the exhibit are the Museum of Anthropology of the University of British Columbia, the Center for Japanese Studies of the University of Michigan, and the Japan Foundation. Granting agencies are the National Museum of Canada, the Department of External Affairs of the Government of Canada, the Koerner Foundation, the National Endowment for the Humanities, the Association for Asian Studies, the Japan-U.S. Friendship Commission, the Agency for Cultural Affairs and the Ministry of Foreign Affairs of the Government of Japan.

The 44-page catalog of the exhibit, written by Richard Pearson, curator of archaeology of the University of British Columbia Museum of Anthropology (and organizer of the exhibit), is available at the Field Museum Shop.*

The following outline of Japanese archaeology is adapted from the catalog, *Image and Life: 50,000 Years of Japanese Prehistory,* by permission of the author:

JAPANESE ARCHAEOLOGY
FOUR STAGES OF PREHISTORY

**Palaeolithic Period**
*(50,000-11,000 B.C.)*

Following a breakthrough in the late 1940s, Japanese archaeologists have found hundreds of Palaeolithic sites in the past 30 years. Prior to that time it was believed that humans had lived in Japan only after about 3,000 B.C. The first Palaeolithic sites were found in the Tachikawa volcanic ash Loam Beds. . .in the Kanto Plain region. Previously it was believed that human remains would never be found in the loam because human occupation was too recent. Other Palaeolithic sites have now been recognized all over the Japanese islands. A few have been dated to over 50,000 years ago, . . . Not all archaeologists accept the early dating. . .or the identification of some of the specimens as worked by humans. However, there seems to be a general similarity between some of these early specimens and the tools from early sites of the Korean peninsula and China, . . .

The Palaeolithic Period in other parts of the world such as Africa, Europe, and China has been divided into three major stages — Early, Middle, and Late, based on the evolution of tool-making techniques. In Southeast Asia, there is still great uncertainty about the age of many crude-looking assemblages; . . . The same problem has been discussed in the case of Japan — the dating of tools which from their crudity appear to be very old, but on the basis of geological data and their association with more refined tool types, may be more recent. Their technological simplicity does not necessarily mean that they are the very oldest. It may be that they were used for simple tasks and rapidly discarded, by people who could make more complicated tools for fine work. . . . There are still many interesting problems about the chronological relationships of the stone tools which are represented in this exhibition. . . .

Since it is very rare to find bones associated

*Incised pebble with hairlike motif. Incipient Jomon (about 10,000 B.C.). Length 6 cm (2.4. in.). Ehime Prefecture.*

**$2.00 each, 10% discount for Members. Mail orders should be directed to the Field Museum Shop and include 50¢ per copy additional for postage and handling.*

with Palaeolithic implements in Japan because of the acidic nature of the soil and the humid environment, we have little concrete evidence for the diet of Palaeolithic people. From fossil deposits it is known that mammoths, large elk, bison, and other Pleistocene animals lived in Japan. They could have provided good game for hunters at that time. . . .It is thought that small family groups may have converged into larger groups at one time of the year to hunt these large animals. . . . Remains of wild peaches, wild grapes, walnuts, acorns, chestnuts, beechnuts, and lotus root have been found. . . . In winter, supplies of pine seeds and walnuts may have been important.

While the climate was colder than present during the Late Palaeolithic, . . . Japan was not covered with a continuous ice sheet. . . . Flora and fauna, including humans, continued to exist even in the northern island of Hokkaido. . . .

Although there are few human fossils from Japan, . . .one enigmatic site [on the south coast of Okinawa] has been dated to about 18,000 years. . . . [This, together with another] dated at 30,000 years ago. . . appears to show that humans lived even on the offshore islands of Japan in early times. . . . By 20,000 years ago sea transport was sufficiently developed that fine materials could be obtained from distant islands off the coast. . . . From. . .southwestern Japan, a house. . .has been found dating to the end of the Palaeolithic.

Many stone tools found in the Japanese Palaeolithic are similar to those found in other parts of the world, such as backed blades which were used as knives, or the large blades of obsidian. Many of the oldest techniques of manufacturing stone tools are similar to those found in China or the Korean peninsula. . . . At least two methods [are] unique to Japan. . . . Thus, Japan, in the final years of the Pleistocene, shared many cultural attributes with eastern Asia and the North Pacific region, at the same time making several innovations. . . .

*Jomon figurines*

**Jomon Period**
*(circa 11,000-300 B.C.)*

As in many parts of the Old World, the end of the Palaeolithic Period is marked by the appearance of microliths and bifacial stone points. . . . Greater specialization within different forms of stone tools in the various regions of Japan may indicate greater permanence of settlement at this time. These tools [gave] way later to chipped arrow and spear points and chipped and ground adzes and axes. Shortly before 10,000 B.C., pottery — the oldest. . .in the world — was invented in Japan. . . .

The earliest shapes of pottery vessels in Japan, which are quite unlike those known from [the People's Republic of China] or Taiwan, have a pointed bottom with sharply sloping sides. From these vessels a wide range of different forms emerged. . . .

While the entire period is termed *Jomon*, which refers to the twisted cord-mark decoration of the pottery, the method of pressing or rolling the various kinds of twisted cords on the wet surfaces of the clay was only one of a huge number of surface treatments. . . . Lacquer was applied to Jomon pottery as early as the Early Jomon.

We are fortunate in having a good sample of wooden tools from Jomon sites. These. . .include compound bowls, dishes with pedestal foot, spear shafts, spoon-shaped objects, oar-shaped objects, handles from stone axes, tools for making fire, and canoes, . . . In addition to objects of wood, the Jomon people were proficient in stone and bone working. . . .

The identity of the Jomon people has been a

*Handle of single-edged sword, house ornament. Kofun Period (2nd half of 4th century A.D.), from Nara Prefecture.*

topic of much debate. Some scholars have suggested that they were the Ainu, who were pushed to the north with the coming of the Yayoi people from the Korean peninsula. It appears more likely that there were several different groups of people living in the Japanese islands during the Jomon, and that the Ainu may have been one of them.... Although many Japanese feel somewhat distant from the Jomon Period, because the people of the Jomon were pre-literate, there are many strands of cultural continuity running from the Jomon to later periods. One of these is the Japanese taste for chestnuts, fern shoots, lily bulbs, and a host of other products from the mountain slopes when they are fresh and in season. The natural vitality of Japanese ceramics, in later periods, even when exposed to almost overwhelming continental influences, is another.

**Yayoi Period**
*(circa 300 B.C.-A.D. 300)*

The third great period of Japanese prehistory, the Yayoi, is short in comparison with the Jomon. Contact from southern Korea and the Yangtze delta area of China and increases in population density and higher productivity with the advent of cultivation brought changes in the society. Weaving of fabrics, metallurgy, forms of ceramics, and wooden and stone tools, burial forms, and house styles, all changed with the Yayoi....

The ceramics of the Yayoi Period bear a strong resemblance to those of the Korean peninsula; at the same time there are many local innovations which show that the Yayoi was not merely a copy of [Korean] culture. They contrast with the ceramics of the Jomon Period in the simplicity of their shapes and the lack of decoration, and their coarse orange paste. The typical shapes are flat dishes on tall feet, jars with straight or constricted necks, and bottles....

In addition to the pottery, other new forms of technology appeared. New wooden tools associated with paddy agriculture made it possible to work the wet marshy soils which were the first of rice cultivation.... Some of the wooden tools actually became weaker and less functional in Late Yayoi presumably under the influence of the iron tools. Most spectacular,...were the metal objects traded to Japan. These were swords, daggers, halberds, and spears...manufactured in Korea, and Chinese mirrors....

Toward the end of Yayoi, the Japanese began to make some of their own bronze weapons, which were generally wider and longer than the Korean prototypes. Many examples appear to have been made solely for burials rather than for actual use....

From Late Yayoi sites, certain burial areas were marked off for people of higher status,... There is evidence that social groups were becoming organized along class lines rather than in egalitarian kinship units. In contrast, Jomon burials yield almost no grave goods or other signs of differentiation, and are not found in localized cemeteries.

One can only speculate why human representation is rare in Yayoi. Perhaps with the beginnings of agriculture, the Japanese were led away from a supernatural world to a more abstract world of nature....

**Kofun Period**
*(A.D. 300-600)*

The fourth great period of Japanese prehistory has been named the Tomb, or Kofun, Period. Until recently our knowledge came primarily from the excavations of the impressive burial mounds.... Recent rescue excavations, carried out in preparation for large industrial projects, have provided both the necessity and the resources to carry out wide-scale excavation of dwelling sites....

Although many of the tombs are round, the most typical form,...is...a round mound with a trapezoidal extension to it. Within these tombs which are often surrounded by one or several moats, are stone chambers containing sarcophagi....

The grave furnishings included armor, weapons, jewelry, and mirrors which were most often of local manufacture....many of the most impressive objects were made of iron or steel, which... has now disintegrated to rust. These iron objects are in contrast to the bronze materials in Yayoi burials. Grave pottery, of a new type — grey reduced stoneware. ..in the form of large footed stands, footed plates, cups, and jars — was placed in the tombs. The weapons and prestige objects as well as the enormous tombs, which required a great deal of coordinated labor..., are signs that the social order consisted of a number of states with clearly defined classes, maintained by military power, and a wide system of trade links.... □

# Commitment to Distinction

Major Contributions in Support of Field Museum's Program of Research, Education, and Exhibition

Field Museum depends in large measure upon the generous gifts of individual Members, corporations, and foundations. Because of relentless inflation, it has become endemic to all not-for-profit cultural institutions that budgeted expenditures annually exceed known sources of revenue—creating the "income gap."

This major problem at Field Museum is being attacked in three ways. First, the Museum is making every effort to increase funding from the public authorities: the Chicago Park District tax levy, the State of Illinois Legislature, and various federal bodies that award grants to museum-oriented programs and research. Second, the Museum is in the process of establishing a *Planned Giving Program*, to provide life-income trusts to donors and aggressively to seek bequests. The third effort is the current program of seeking gifts and pledges to the annual operating fund.

Since the beginning of the program, as of August 31, 1979, the Museum has received $7,849,318.34 in gifts and pledges for restricted and unrestricted purposes.

This has been accomplished through the generosity of more than 450 corporations and foundations and more than 4,000 individual contributors each year. Those donors on the Honor Roll (a gift of $1,000 or more) so far in 1979 (through August 31) are:

### Individuals
### Jan. 1—Aug. 31, 1979
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Mrs. Alexander G. Armour
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Dr. and Mrs. Robert W. Carton
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A.G. Cox Charitable Fund
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Mr. and Mrs. Albert E.M. Louer (Rose Mandel Louer Trust)
Mr. McKim Marriott
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Mrs. David B. Stern
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Mr. Bolton Sullivan (The Bolton Sullivan Foundation)
Mr. and Mrs. John W. Sullivan
Mr. and Mrs. James Swartchild (The Collier-Swartchild Foundation)
Mr. and Mrs. Phelps H. Swift (The Ruth & Vernon Taylor Foundation)
The Edmund B. Thornton Family Foundation
Misses Mildred and Grace Tress
Mr. and Mrs. Theodore H. Van Zelst (Minnan, Inc. Foundation)
Mr. and Mrs. Frank Voysey
Mr. and Mrs. Blaine J. Yarrington

### Corporations
### Jan. 1—Aug. 31, 1979
### $5,000 and over

Anonymous
Alcoa Foundation
Allstate Foundation
Beatrice Foods Co.
Borg-Warner Foundation, Inc.
Burlington Northern Foundation
Chicago Community Trust
Consolidated Foods Corp.
Continental Bank Foundation
Esmark, Incorporated Foundation
Marshall Field & Company Foundation
Ford Motor Co.
General Electric
General Mills Foundation
Harris Bank Foundation
Hart, Schaffner & Marx Charitable Foundation
Illinois Bell Telephone Co.
IMC Foundation
Fred S. James & Co.
Kraft, Inc.
Oscar Mayer Foundation
Gust K. Newberg Construction Co.
Northern Illinois Gas Co.
The Northern Trust Co.
Peat, Marwick, Mitchell & Co.
Peoples Gas Co.
The Albert Pick, Jr. Fund
Power Systems, Inc.
United Airlines Foundation
United States Steel Foundation, Inc.
Western Electric Fund
Westinghouse Electric Corp.

### Corporations
### Jan. 1—Aug. 31, 1979
### $1,000-$5,000

American National Bank and Trust Co. of Chicago
Bliss & Laughlin
Bunker-Ramo Foundation
Leo Burnett Company, Inc.
Carson, Pirie, Scott Foundation
Chamberlain Manufacturing Corp.
Chicago Bridge & Iron Foundation
The Chicago Tribune Foundation
Crane Packing Co.
Crum & Foster Foundation
DesPlaines Valley Geological Soc.
The Ehlco Foundation (Edward Hines Lumber Co.)
Ernst & Ernst
General American Transportation Foundation
Gould Foundation
Household Finance Co.
Interlake Foundation
International Business Machines Corp.
Kemper Educational and Charitable Fund
Lloyds Bank International
McLean-Fogg Lock Nut Co.
Masonite Corp.
McGraw-Edison Co.
John Mohr & Sons
Motorola Foundation
L.E. Myers Co.
National Boulevard Foundation
New York Life Insurance Co.
Oak Park Trust and Savings Bank
Pullman, Inc. Foundation
Prudential Foundation
Quaker Oats Foundation
Rockwell International
Shell Companies Foundation
SRA Foundation
Stewart-Warner Foundation
Turner Construction Co.
UOP Foundation, Inc.
Victor Foundation
Wallace Business Forms Foundation
Harry Weese & Associates
Ben O. Warren Foundation
E.W. Zimmerman, Inc.

# THE NATURAL HISTORY MUSEUM

## *An Historical Sketch*

*By* Cecile Margulies

AS A NATURALLY ACQUISITIVE ANIMAL, man has probably been collecting objects of one sort or another since prehistoric times. As he has evolved, however, the reasons for collecting and the nature of the materials to attract his attention have, of course, changed. The assumption is reasonable that early man accumulated natural objects because of their utilitarian value or for the magical properties attributed to them. But modern man collects objects because of their scientific or educational value, often through the vehicle of that unique institution, the natural history museum.

In ancient Egypt, Greece, and Rome, the priests, as custodians of the temples, decided what went into the collections housed there. Since they particularly valued rare or "magical" objects, natural history specimens — especially precious stones and objects of supposed medicinal value — came into the collections. Today such collectibles are often lumped under the rubric "curiosities." In his *Natural History,* written 2,000 years ago, Pliny the Elder mentions many such items, including the bones of a monster slain by the mythical Perseus.

In medieval times, collections were to take on an even more motley character, a condition for which the church was largely responsible. Anything believed to be of religious value was eminently collectible, especially by credulous travelers, crusaders, and pilgrims. Religious relics, illuminated manuscripts, rare coins, medals, precious stones, elephants' tusks, as well as objects alleged to be unicorn horns, bones from Jonah's whale; griffins' claws, and so on filled the treasure chambers of medieval monasteries, churches, and castles.

The kind of natural objects ordinarily present in the collections of royalty and noblemen qualified on the basis of rarity or for attributed legendary quality. These early forerunners of natural history collections were often housed in so-called "cabinets of curiosities," and these, in turn, were set up in specially designated rooms. The cabinet of Jean, Duc de Berry (1340-1416) contained carved crystals, ostrich eggs, polar bear skins, and what were believed to be giants' bones and sea monsters.

With the new humanistic and scientific spirit that characterized the Renaissance, there were also visible changes in the purposes behind collecting. Objects of nature were now looked upon with more concern for their intrinsic value than for symbolic or religious significance imputed to them. Although Aristotle and Pliny remained the final authorities in matters of natural history, their influence was being eroded by an increasingly sophisticated approach to science. Among the early naturalists who had collections of natural history specimens and other collectibles were Philippus Paracelsus (1493-1541), the noted Swiss physician and alchemist; and Georgius Agricola (1494-1555), the so-called father of mineralogy. Indeed, the writings of Agricola induced the Elector Augustus I (1526-1586) of Saxony to form a collection of both art and natural objects that ultimately filled seven rooms of the royal palace in Dresden.

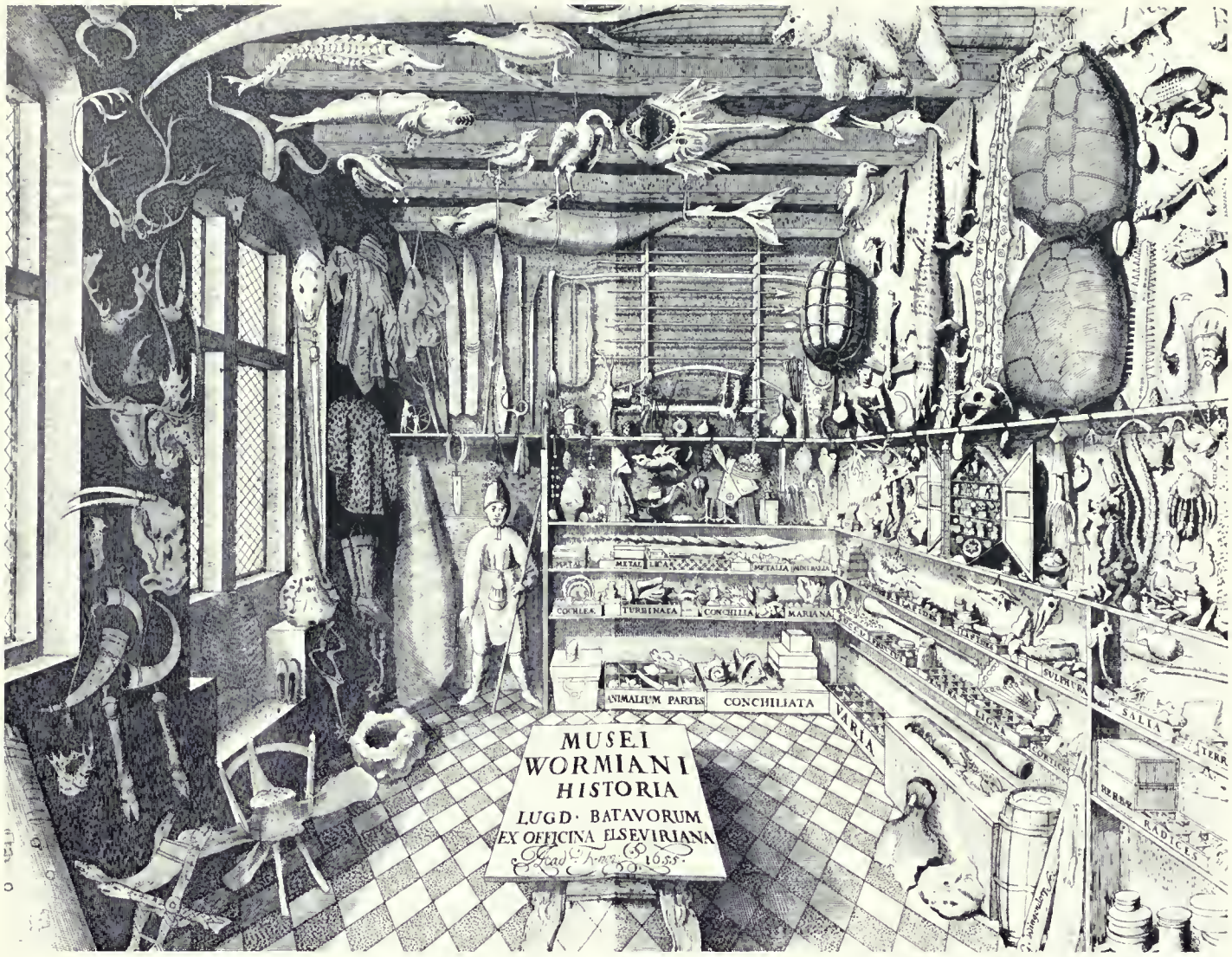
By the sixteenth century there were about a dozen outstanding princely collections, such as that belonging to the Archduke Ferdinand of Tirol (1520-95) at Schloss Ambras. In these, natural history objects were to be found together with carved gems, montages of seashells, and decorative items fashioned from a variety of natural substances. The special repository for them was the *Wunderkammer* — the room of curiosities. Sometimes this room was designated the "cabinet," a term also applied to chests containing smaller items.

These chests were often elaborately carved, inlaid, and painted with naturalistic representations of insects and plants. A particularly elaborate cabinet, made about 1617 for Duke Philipp II of Pomerania and now preserved in Uppsala, Sweden, is several tiers high, has drawers of ebony and numerous doors that swing open to reveal facades of cameos and rare woods. Atop the cabinet is a chalice of silver, coconut, and coral, adorned with a montage of minerals and shells and surmounted finally with statuettes of Neptune and Venus. Another exceptionally fine cabinet, to be seen in the Smithsonian Institution, is believed to be partly the work of Jan van Kessel (1626-79), of Antwerp. Made of veneer and marquetry, it has ten drawers and a central door panel painted with life-size images of insects. (See photos on p. 12.)

Such privately owned cabinets, with their random assortments of objects, were maintained for the edification and pleasure of the owner and his family and friends. But by the sixteenth and seven-

*"The Artist in His Museum," by Charles Willson Peale, in the Joseph and Sarah Harrison Collection of the Pennsylvania Academy of the Fine Arts, Philadelphia. The self-portrait, completed in 1806, shows Peale in his natural history museum, the Peale Museum, later renamed the Philadelphia Museum.*

*Cecile Margulies was formerly Field Museum Public Relations assistant.*




*Typical of seventeenth-century natural history museums was this "wonder room" of Olaf Worm, a Copenhagen physician and famous student of natural history. From a woodcut made by G. Wingendorp, the frontispiece to the 1655 catalog of Worms's collection.*

teenth centuries collecting was no longer an exclusive pursuit of the nobility; wealthy merchants, scientists, and scholars were now also collecting. Collections of this period were notable for the emphasis placed on the role of an organism or object in the scheme of nature. Entire cabinets were devoted to animals, to plants, or to minerals, as distinct and separate categories.

None of these early collections, unfortunately, has survived intact. Largely because of economic uncertainties of the times, they were frequently sold, piecemeal, to settle the debts of their owners — merchants, dukes, even cardinals and princes. Many objects, however, managed to find their way into private collections and ultimately into museums.

British collections arose in a manner different from those on the Continent. While each of the great Continental museums developed from a princely collection that was at best an assortment of curios, those in Britain tended to originate in the collections of scientists and educated travelers, and these were marked by a new concern for organization and system.

With the Age of Enlightenment and an increased recognition of knowledge as a tool for harnessing nature, universities began acquiring collections for learning and teaching purposes. At the University of Leyden, for example, a wide range of materials, including objects of an archaeological and ethnological nature, were assembled. The specimens were housed in the anatomy theater, intended primarily for medical lectures and demonstrations. Birds and animals were hung about the operating theater, and cases and cupboards crammed with specimens stood everywhere, even in the entrance hall.

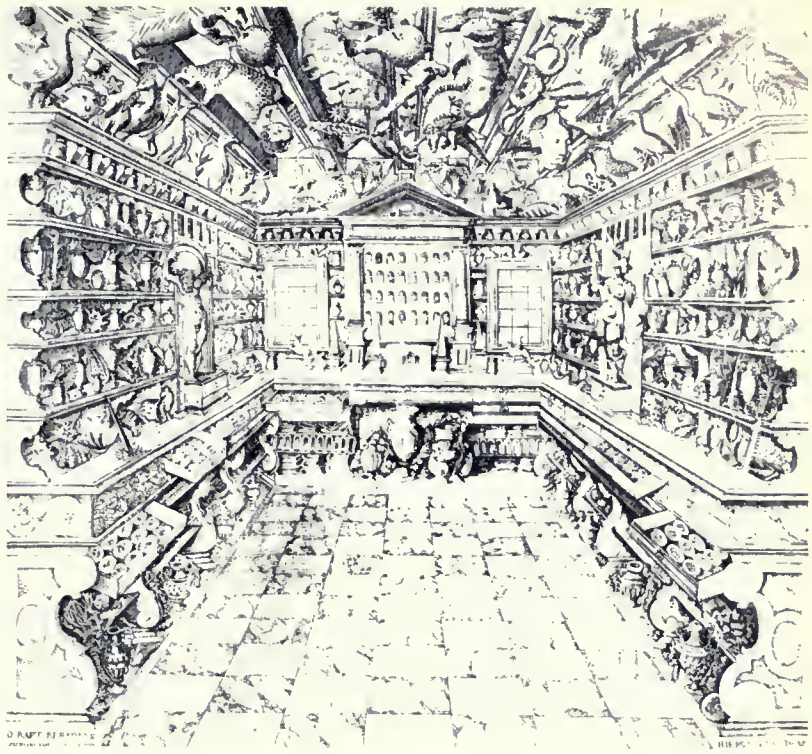
Many collectors of the sixteenth and seventeenth century were scientists motivated by their interest in the advancement of human knowledge, and the range of their collections often far exceeded their own professional spheres. As the vista of science broadened, so did man's geographic horizons, and archaeological and ethnological items from exotic lands appeared with increasing regularity in Europe's natural history collections. The French essayist Montaigne (1533-92) was among those with ethnological collections; Valentini, court physician to the Duke of Hesse, was a collector of religious idols.

Three of Europe's great museums of the present time owe their origins to seventeenth-century men who acquired extensive private collections: John Tradescant the Younger (1608-62) and Sir Hans Sloane (1660-1752), both of England; and France's Gaston, Duke of Orléans (1608-60). Tradescant, a naturalist and traveler, was supervisor of the

gardens of Charles I. His collection, known popularly as Tradescant's Ark, an enlargement of his father's collection, was bequeathed to a friend, Elias Ashmole (1617-97), an archaeologist and antiquary. It included such diverse items as "Dodar [dodo], from the Island Mauritius; it is not able to flie being so big." "A Cherry-stone, upon one side S. Geo: [St. George], and the Dragon, perfectly cut: and on the other side 88 Emperours faces, " "Anne of Bullens silke knitgloves," and "Shooes to walk on Snow without sinking."

Ashmole incorporated Tradescant's bequest into his own extensive collection, and in 1675 he donated all these materials to Oxford University; thus was established the Ashmolean Museum, England's first public scientific institution. It was formally opened in 1683.

Sir Hans Sloane, president of the College of



*The museum of Francisco Calceolari, the Younger (rt.) in 1622 and that of Ferrante Imperato (1550-1630), of Naples (below). The Worms museum (opposite), it should be noted, included much material of an ethnological nature as well as animal, plant, and mineral specimens. The two museums shown on this page, from a slightly earlier period, appear to be limited to zoological specimens.*

At left and below: *the exterior and the internal panel work of a 17th-century cabinet of curiosities, now in the Smithsonian Institution, Washington, D.C. The center panel is attributed to Jan van Kessel (1626-79), of Antwerp.*

Physicians and of the Royal Society of England, was, like Tradescant, an inveterate traveler. Over the years he acquired other collections, supplementing his own, eventually amassing nearly 70,000 specimens. His material was to form the nucleus of the British Museum.

One of the Continent's great collections was that of Gaston, Duke of Orléans, a son of France's Henry IV. This was purchased in 1660 by Colbert, a minister in the court of Louis XIV. In 1793, in the wake of the French Revolution, the collection was nationalized, becoming the Muséum Natural d'Histoire Naturelle, of Paris.

By the eighteenth century, interest in curios extended well beyond the sphere of scholars and noblemen; the collecting of curiosities was looked upon as a proper avocation for the cultivated gentleman, and was even recommended as an antidote for lethargy. During the 1700s the collections came into commercial use, as Don Soltero, a Chelsea coffeehouse proprietor, used his as an added attraction for patrons.

For the most part, however, access to natural history collections was limited to friends and acquaintances of the owner. Even when the Ashmolean Museum was opened to the public in 1683, it was intended as a resource for scholars rather than as a facility for the general public. This restriction prevailed well into the nineteenth century.

*"Exhuming the first American Mastadon," by Charles Willson Peale (painted 1806-08). The Peale Museum, Baltimore.*

The late eighteenth and the early nineteenth centuries, marked by rapid political, economic, and social changes, was also a time when a number of the great public museums came into being. In Europe, noble families and wealthy merchants often found themselves forced to sell their collections; in other cases these possessions were simply confiscated by the state. The empty palaces, as a matter of political expediency, became public facilities. In America museums developed differently: neither as a use for vacated palaces nor as repositories for collections once held by the nobility. A product of nineteenth-century liberal thought, the American museum was developed almost from its beginnings, as a public facility. Man as a rational creature capable of continuous improvement, needed only education and political equality to make him virtuous and happy. Thus, education was — and still is — an important function of the American museum.

The earliest collections on this continent were modest; however, as the colonists began to prosper in the eighteenth century, the gentleman's curio cabinet grew fashionable among the gentry, just as it was in England. Colleges in the colonies, too, began to take an interest in collections. Harvard College's natural history collection, dating from at least as early as 1750, was to become a century later, the University Museum at Cambridge. In 1773, three years before the American Revolution, the Library Society of Charles-Town resolved to collect material for a natural history of South Carolina. The result — what is now the Charleston Museum — was the first public museum to be established in the Western Hemisphere.

Many of the early American museums, located in eastern seaboard cities, included collections of artworks as well as of the sciences. The first important public museum, the Peale Museum, was established in 1786 in Philadelphia by the renowned portrait artist Charles Willson Peale (1741-1827), who also had a strong interest in the natural sciences. His museum, later named the Philadelphia Museum, was first housed in an annex to Peale's house. As the collection grew in size and attracted greater interest, the museum was moved (1802) to the top floor of Independence Hall. Among the exhibits were mounted and preserved animals which were carefully labeled and arranged in dioramas — a practice that was a full century ahead of its time.

A mastadon skeleton excavated by a Peale-financed expedition in 1801 was among the museum's more popular exhibits. The excavation

Overleaf: *A central exhibit hall of the Field Columbian Museum (former name of Field Museum) in 1890s, located in Chicago's Jackson Park. Note the variety of materials exhibited in this one hall: zoological, botanical, and ethnological material, as well as baroque sculpture. The lower cases, on legs, contain molluscs and other marine animals. Two visitors, seated, may be seen at left center.*

*The Manhattan museum of entreprenuer Phineas T. Barnum, ca. 1858. A circus owner and showman, Barnum's interest in the museum was presumably just as a business venture. He was one of the first to capitalize on the fascination that lifeless specimens (as well as fraudulent ones) have for the general public.*

was the subject of Peale's painting *Exhuming the First American Mastadon* (1806), now in the present Peale Museum, located in Baltimore. The collections in Independence Hall also included wax figures of American Indians, a display of their tools and weapons, and casts of famous statues.

Many of the early American museums were founded and supported by historical and fine arts societies. Peale had the novel idea that a public institution should draw the interest and support of the populace. He and Benjamin Franklin were, in fact, instrumental in developing the idea of a membership plan for the public museum. This concept never fully exploited until relatively recent times, is now of course an important feature of the museum in America.

A singularly important event in the development of the American public museum occurred in 1829 when James Smithson (1765-1829), an Englishman, bequeathed his fortune to the United States with the explicit purpose of creating a public facility for the "increase and diffusion of knowledge among men." The resulting Smithsonian Institution, orginally a museum, has over the years grown to encompass a complex of institutions concerned with a broad range of science, technology, history, and the arts: the National Museum of Natural History, the National Air and Space Museum, the National Gallery of Art, the John F. Kennedy Center for the Performing Arts, and the National Zoological Park, among others.

During the second half of the nineteenth century, in Europe as well as the United States, there was a rapid increase in the founding of museums. In America this was in part the consequence of geographic and economic expansion, with funds coming from federal as well as private sources. Federally sponsored expeditions, such as that of Meriwether Lewis and William Clark to the Northwest (1804-06), brought back a great variety of specimens which found their way into museums in Philadelphia, Boston, Washington, and Chicago. Municipalities began to support museums through tax revenues, as in the case of the American Museum of Natural History in New York, founded in 1869.

The enormous private fortunes that were amassed in the United States following the Civil War were a boom to museums, as the uniquely American philanthropist made contributions to the community for its educational improvement and moral uplift. The personal fortune of Chicago businessman Marshall Field (1834-1906) was, in fact, to be the cornerstone of the Columbian Museum of Chicago, founded in 1893, and today known as the Field Museum of Natural History. □

*A main exhibit hall in the Field Columbian Museum (earlier name of Field Museum) in the 1890s, when the Museum was located in Jackson Park, Chicago. (The mammoth shown here was a reconstruction based on skeletal remains.)*

*Exhibit cases being removed (ca. 1920) from Jackson Park quarters of what was by then known as the Field Museum of Natural History (changed from "Field Columbian Museum" on Nov. 8, 1905); 321 railroad cars of specimens and equipment were removed from Jackson Park to the present Field Museum building, which opened formally on May 2, 1921.*

# SECOND ANNUAL FESTIVAL OF ANTHROPOLOGY ON FILM

**Field Museum of Natural History**
**West Entrance**

Friday, Nov. 30, 1979; 5:00 p.m. - 9:30 p.m.
Saturday, Dec. 1, and Sunday, Dec. 2, 1979 11:00 a.m. - 5:00 p.m.

*The recognition that forms of human behavior still extant will inevitably disappear has been part of our whole scientific and humanistic heritage. There have never been enough workers to collect the remnants of these worlds, and just as each year several species of living creatures cease to exist, impoverishing our biological repertoire, so each year some language spoken only by one or two survivors disappears forever with their deaths.*

*— Margaret Mead*

Field Museum invites you to experience the cultures of the world on film. Ethnographic films, describing through illustration the patterned behavior of particular cultures, are a genre of film that is as old as the cinema itself.

Cinematic voyages to Afghanistan, the wintry homes of the Netsilik Eskimo, the jungles of Venezuela, and the sands of the Kalihari will enhance your understanding of peoples vanishing with the encroachment of our modern world.

The Festival consists of films from seven cultural areas: China, South America, South Africa, North Africa, Central Asia, Melanesia, and North America.

The main culture films will be shown in James Simpson Theatre and Lecture Hall I. Men and women, music, drama, dance, agriculture, technology, and humor, irony, and parody are the topics of films to be screened in Lecture Hall II. Selected films not confirmed are listed "to be announced." The complete film schedule will be available at the Film Festival.

Friday, November 30, 1979
5:00 p.m. - 9:30 p.m.
James Simpson Theatre

Introduction by Martha Foster Breidenbach, Audiovisual Programmer, University of Illinois at Chicago Circle.

*Photography: Dorothea Lange, Part II: The Closer for Me* (1965) 30 m. National Education Television U.S.A. Artists Series.

Lange's attempt to get close to the human being and to achieve a type of photography she described as "what is really there—the underpinning of the human condition."

CHINA

*Film to be announced*

*Chinese Jade Carving.* 10 m.
Wan-go Weng.
Kung-fu-Mah, a fourth-generation jade artisan, demonstrates basic jade-carving techniques.

*Film to be announced*

*Women in China* (1976) 26 m.
Betty MacAfee
Shows many aspects of women's lives in the People's Republic of China: childbirth, home life, at work in factories, and caring for children.

*2100-Year-Old Tomb Excavated* 30 m.
Grove Press, N.Y.

Records the exciting discovery of a 2,100-year-old tomb in central China containing the body of a woman and burial accessories in a remarkable state of preservation.

Lecture Hall I
5:45 p.m. - 9:30 p.m.

SOUTH AMERICA, SOUTH AFRICA

*The Feast* (1968) 29 m.
Timothy Asch and Napoleon Chagnon
The classic illustration of feasting practices of the Yanomamo of Southern Venezuela.

*Tapir Distribution* (1971) 15 m.
Timothy Asch and Napoleon Chagnon
Shows how the tapir, a piglike animal, is killed, cooked, and distributed among the Yanomamo tribe.

*Magical Death* (1970) 29 m.
Napoleon Chagnon
Describes and underscores the role of spiritual coercion and spirit manipulation practiced by the Yanomamo. An intense, powerful film.

*Children's Magical Death* (1975) 7 m.
Timothy Asch and Napoleon Chagnon
Shows a group of Yanomamo boys emulating their fathers by pretending to be shamans.

*Tug of War* 9 m.
Timothy Asch and Napoleon Chagnon
The women and children of a Yanomamo village play a game of tug-of-war.

*Film to be announced.*

Saturday, December 1, 1979
James Simpson Theatre
11:00 a.m. - 5:00 p.m.

Introduction by Dr. Paul Hockings, associate professor, Department of Anthropology, University of Illinois at Chicago Circle.

CHINA, AFRICA

*China Today* (1972) 22 m.
NBC
An up-to-date statement on a vigorous country, which shows the nation concentrated on economics, agriculture, education, and medicine.

*Chinese, Korean, and Japanese Dance* (1965) 28 m.
Clifford Ettinger and Beate Gordon, Board of Education of the City of New York in conjunction with the Asia Society.
Examines the origins, history, and development of Oriental dance forms.

*Film to be announced.*

*Un Matin d'Été à Matamata* (1977) 30 m.
*("A Summer Morning in Matmata")*
François Ode
A humorous and poignant look at interactions between Western tourists and the Berbers of Matmata, Tunisia.

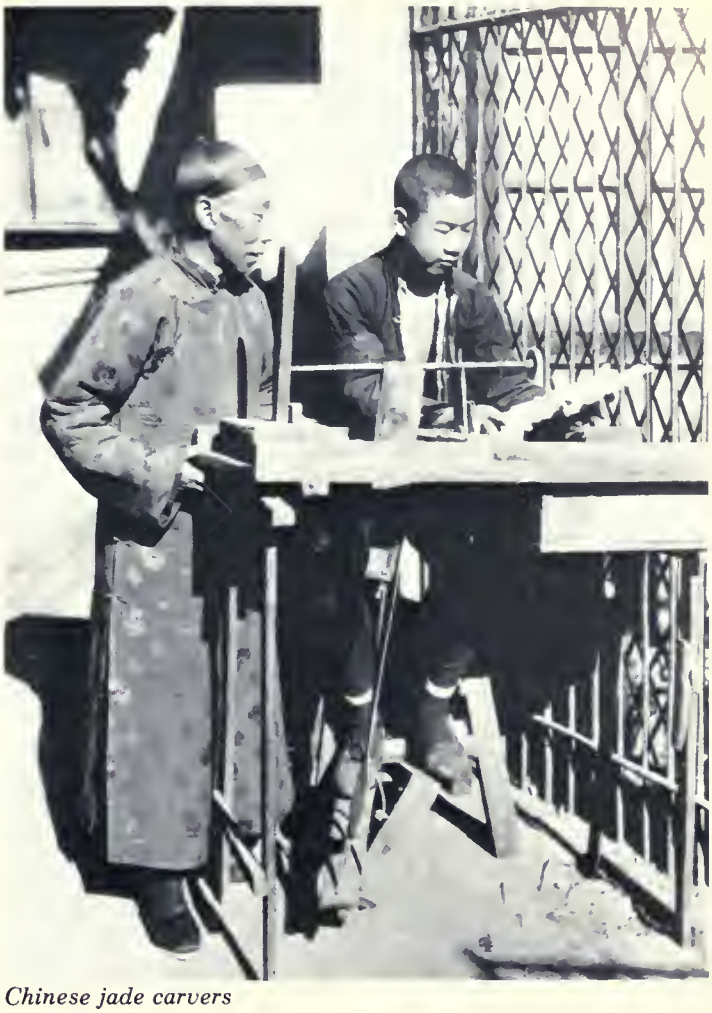
*Jaguar* (1953-67) 93 m.
Jean Rouch
Improvised ethnographic document of three young men from Niger who trek south through Dahomey to Ghana and the Ivory Coast in search of wealth and adventure.

*Under the Men's Tree* (1974) 15 m.
David MacDougall
Jie tribesmen of northeastern Uganda gather in their accustomed place under the men's tree to perform daily chores and engage in some priceless conversation.

*Mbira Njari: Karanga Songs in Christian Ceremonies* 22 m.
Gei Zantzinger and Andrew Tracey
Shows use of the *mbira*, or thumb piano, on ceremonial occasions in a Shona village from Zimbabwe (Rhodesia). From a series of eight films exploring the music of several southern African peoples.

*Anansi the Spider* (1969) 10 m.
Gerald McDermott
African folk tale tells the story of Anansi's six sons who attempt to save him from a fish of the sea and a hawk of the air. Anansi's efforts to reward the one who saves him lead him to the origin of the moon.

*Masai Women* 55 m.
Melissa Llewelyn-Davis and Chris Curling
Masai women explain their subordinate position to the men in their society, revealing their goals and attitudes against the background of initiation rites, dances, and marriage ceremonies.



*Chinese jade carvers*

Lecture Hall I
11:00 a.m. - 5:00 p.m.

CENTRAL ASIA

*The Painted Truck* 28 m.
Judith and Stanley Hallet and Sebastian C. Schroeder
There are but two methods of transportation in Afghanistan — camels and trucks, and the big trucks are taking over. The truck driver in this film tells what it is like to live and work in Afghanistan, and unconsciously reveals the social structure, traditions, and culture of his country.

*Naim and Jabar* (1975) 50 m.
American Universities Field Staff
Lyrical ethnographic expression of the hopes, fears, and aspirations of two adolescent boys in rural Afghanistan.

*Cinema* 3 m.
Sebastian C. Schroeder
An enterprising man from Kabul, Afghanistan, attracts quite a crowd with his home-made, hand-cranking street cinema.

*Two young Samoan women*

Sunday, December 2, 1979

MELANESIA AND AUSTRALIA

James Simpson Theatre
11:00 a.m. - 5:00 p.m.

*Trobriand Cricket: An Ingenious Response to Colonialism* (1976) 54 m.
Jerry Leach
Documents the transformations of the staid traditional British game of cricket, introduced by missionaries at the turn of the century, into the politically powerful, sensually aesthetic Trobriand version.

*Film to be announced.*

*Film to be announced.*

*Coniston Muster* (1973) 29 m.
Roger Sandall
Vivid collection of scenes from the life of 60-year-old Aboriginal stockman as he and his fellow "cowboys" are shown carrying out the annual muster, or round-up on a ranch in central Australia.

*Yumi Yet: Independence for Papua New Guinea* (1977) 54 m.
Dennis O'Rourke
*Yumi Yet* means "we ourselves," and this film portrays the diverse culture, beautiful landscape, and feelings of the emergent nation of Papua.

*Island of the Red Prawns* (1978) 52 m.
Australian Broadcasting Commission
Documents Fiji Island culture by recording the traditional wedding of the children of two important chieftains. During the wedding feast the legend of the red prawns is told in song and dance.

*Film to be announced.*

Lecture Hall I
11:00 a.m. - 5:00 p.m.

NORTH AMERICA

*Nanook of the North* (1922) 55 m.
Robert Flaherty
Classic, pioneering documentary shows the life of an Eskimo family, including hunting walrus, eating, fishing, building an igloo, and preparing for the Arctic winter.

*The Owl Who Married a Goose* (1974) 8 m.
Caroline Leaf
An animated Eskimo legend utilizing the voices and sounds of Eskimos.

*Fishing at the Stone Weir* Parts 3 and 4 (1964) 60 m.
Asen Balikci
Balikci documents the Netsilik Eskimo's nomadic cycle. Living in Canada's inaccessible Northwest Territories, the Netsilik establish base camps according to hunting and weather conditions.

*Woven Gardens* 52 m.
BBC and Warner Brothers
Studies the weaving of hand-knitted rugs by the women of the nomadic Qashqua'i of Iran; these beautiful rugs often contain clues to the ancestral history of a tribe.

*Film to be announced.*

*Afghan Village* (1975) 45 m.
American Universities Field Staff
Impressionistic view of daily life in Aq Kupruk, northern Afghanistan.

*Afghan Nomads: The Maldar* (1975) 21 m.
American Universities Field Staff
Depicts the interactions between the nomadic Maldars and the townspeople of Aq Kupruk, northern Afghanistan.

*How to Build an Igloo* (1949) 10 m.
National Film Board of Canada
Presents demonstration of igloo-building in Canada's far north. Explains why snow is carefully chosen, why blocks are built in a spiral, and how an igloo is ventilated.

*Winter Sea-Ice Camp Part III* (1970) 30 m.
*Winter Sea-Ice Camp Part IV* (1970) 37 m.
Asen Balikci
Includes sequences on trekking across sea-ice, building a large ceremonial igloo, seal meat sharing, trials of strength for men, storytelling, and a drum dance.

*The Vigil of Motana (In the Land of Headhunters)* (1914) 38 m.
Edward S. Curtis
Curtis wanted his film to capture a vanishing way of life, but the Kwakiutl Indians of Vancouver Island, Canada, had lost many of their traditional ways by 1914. He resorted to costumes and recreation to fill the screen with heroic conquests, great battles, and impressive wedding dances.

*I Heard the Owl Call My Name* (1974) 78 m.
Daryl Cuke
Sensitive and moving drama, featuring Tom Courtenay and Dean Jagger. A young Anglican priest, unaware that he has only a short time to live, is sent by his bishop to a remote Indian village in British Columbia, Canada, and during his time there he learns "enough about life to be ready to die." Supporting cast of native Indian actors.

*Legend of the Magic Knives* (1970) 11 m.
Encyclopedia Britannica Educational Corporation
The Kwakiutl Indians of British Columbia enliven dramas of winter ceremonies with brilliantly decorated totem poles, masks, and carved figures.

*Iraqi woman spinning*

SPECIAL THANKS to these film distributors for their generosity in extending courtesy loans: Documentary Educationl Resources, Watertown, Ma.; Education Development Center, Newton, Ma.; Granada Television International, New York, N.Y.; Grove Press Film Division, New York, N.Y.; Indiana University Audio Visual Center, Bloomington, In.; Learning Corporation of America, New York, N.Y.; MacMillan/Audio Brandon Films, Brookfield, Il.; Nippon A-V Productions, Tokyo, Japan; Pennsylvania State University, University Park, Pa.; University of California Extension Media Center, Berkeley, Ca.; University of Illinois at Chicago Circle, Chicago, Il.

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# OUR ENVIRONMENT

### Acid Rain: A Long-Term Environmental Headache

Acid rain is a relatively new environmental term that is just beginning to be understood by the general public. But while the actual pairing of words is new, the conditions it describes are not, and neither should they come as a surprise.

In the most simple terms acid rain — and acid snow and snow melt — explains how certain kinds of air pollution return to do more damage on earth, where they orginated. Acid precipitation is the more exact term, because snow as well as rain carries pollutants from the atmosphere, where they can be transported hundreds or even thousands of miles from their source. Acid rain results, basically, when sulfur and nitrogen oxides — primarily from electric power plants, smelters, and automobiles — are chemically changed into acids in the atmosphere. As sulfuric and nitric acids, they are carried wherever wind currents blow before they are brought back to earth in rain or snow.

Acid precipitation was the subject of major presentations at the recent International Joint Commission (IJC) conference on Great Lakes water quality in Detroit. One was made by George Hendrey of Brookhaven National Laboratory in Upton, New York. Since the meetings, Hendrey's straightforward explanations and the urgings of IJC's Science Advisory Board have formed valuable parts of the foundation of acid rain literature that is now becoming available.

Acid precipitation, or acid rain, is a global problem. The effects were first seen in Europe; it affects the Great Lakes and the Midwest because higher-than-normal levels of acidity in rain are found in these areas. Several bays of the Great Lakes — on the Canadian side, in upper Wisconsin and Michigan, and perhaps in Minnesota, say some experts — are now known to receive substantial runoff from freshwater streams that have been made acidic by acid rains. These areas may cause small portions of these bays to become acid, or to retain high levels of toxic metals such as cadmium or aluminum.

The IJC, the U.S.-Canadian entity that monitors the quality and cleanup of the Great Lakes, estimates that emissions of sulfur dioxide in North America are about 23 million tons a year. Of this, approximately 19 million tons are emitted from U.S. sources, with 60 percent coming from the thermal power industry. In eastern Canada, the commission estimates, some 60 percent of sulfur dioxide is a product of the nonferrous smelting industry. Mankind's nitrogen oxides are about 22 million tons a year from the U.S., about equally from fixed and mobile (mainly automobiles) sources. Canada contributes some 1.4 million tons a year of nitrogen oxides, mostly from mobile sources.

While areas within the Great Lakes ecosystem are vulnerable to the ravages of acid rain, the Great Lakes themselves will not become acid lakes. They are "generally well buffered," says Hendrey. He explains that the very geology of the Midwest and of the Great Lakes in particular would prevent that from happening.

The picture is not so optimistic for another important Midwestern resource, however. Soybeans, which are one of Illinois' chief food crops and one of the most important cash crops in the U.S., are known to be affected by acid precipitation.

Hendrey has done "quite a bit of work with soybeans," and his presentation of the Great Lakes-related group in Detroit included slides that illustrate the difference between soybeans grown in nonacid conditions and those grown in a laboratory with various higher levels of acid "rain."

"Anything that would alter the yield and quality of the soybean could have an impact upon protein supply to the world," he explains; "particularly Third World countries, to which we export large numbers of soybean products." Obviously, it also would have an important impact on U.S. farmers and the U.S. economy.

"We have determined kinds of injury one might expect to see on foliage; we've carried out greenhouse experiments, which are preliminary to field experiments, in which we will attempt to evaluate the yield and the quality of the crop under different acid rain treatment."

Plants exposed to acid rain "show acid burns, or lesions, under the most extreme levels (pH of 2.9 on the acidity scale)," Hendrey says. "A rain as low as 2.1 pH has been reported, and rains as low as 2.9 pH occur occasionally in the northeastern United States. Rains in the low 3 pH range occur frequently, and in that pH range soybean damage — while less visible, even microscopic — is evident in many places on the leaves. In addition," he says, "nutrients are leached out of the plants by this rain, which can be known only after chemical analyses of the plants."

To better understand the situation, it may be important to take a step back and look at the terms scientists use. Acids are chemicals that release hydrogen ions in solutions. Scientists use the standard symbol pH to indicate the level of the concentration of these hydrogen ions, on a scale from 0-14. Number 7 shows a balance of acids and alkalines. Numbers below 7 pH show increasing acidity; numbers above 7 show increasing alkalinity. Precipitation is considered acid if it falls below a pH of 5.6, the normal equilibrium value of carbon dioxide and water.

But progression up or down the pH scale is not simple. At 7, acid/alkaline solutions are in balance. But at 6 a solution is 10 times more acid then it would be at 7. At 5 it is 100 times more acid; at 4, it is 1,000 times more acid; at 3, 10,000 times more acid; and at 2, 100,000 times more acid than a solution of 7 pH.

More simply, limes are a bit lower than 2 pH. Household vinegar (acetic acid) has a pH of 2.5. Moselle wine's pH is 3.3, that for orange juice is 3.6, and beer's pH is 4.1. Soda water has a pH of 5.3; "pure" rain, 5.6; and baking soda (sodium bicarbonate), which is often used to neutralize acids, has a pH of 8.5. Toward the high end of alkalinity, ammonia's pH value is 12.

Acid rain, then, is not a new phenomenon. In the 1920s it was noted that numerous small, high-mountain lakes in Scandinavja were becoming acid and devoid of fish. By 1972 evidence that this and several other problems resulted from acid precipitation was so convincing that a major international research program was launched in northern Europe.

Hendrey carried out research in Norway, where it was found that the number of plants and animals is greatly reduced by acidification. "Yet," he says, "a few species are very tolerant and grow very, very abundantly under conditions of acidity. So diversity disappears, while a few species become extremely abundant, expecially sphagnum moss and filamentous algae.

"But this — the adaptation to acidic conditions — is not true of fish: Fish just disappear. Major fishery problems occur at levels as high as 5.5, and there are no fish present when the pH reaches 4.5. Seven major rivers formerly were a major European source for Atlantic salmon; today the salmon from those

seven rivers have completely disappeared. And we have just found out," he continues, "that Nova Scotia is beginning to look just the same as those Scandinavian rivers."

The Canadians claim that 48,000 Ontario lakes are going to become devoid of fish within the next 18-20 years if acid rain conditions continue. This is also true of Quebec, New Brunswick, and Nova Scotia. The Canadians note an alarming decline of salmon eggs in these provinces.

Brookhaven National Laboratory is a prime contractor for EPA (Environmental Protection Agency), and Hendrey is its chief investigator to determine the sensitivity of regions of the U.S. east of the Mississippi, from Minnesota to Florida and up through New England, where the most devastating effects of acid rain have been noted.

In lakes found in the Adirondack Mountains in New York State, long considered prime tourist attractions partly because of their excellent fishing, acid rain has already taken a steep toll. "People [who are in business] in the Adirondacks are very mad at environmental scientists for losing them their tourists," Hendrey says. "We've pointed out that half the lakes in the higher areas have lost their fish. Many [of those lakes] are completely free of fish, lakes that were good fishing lakes in the past. Also, there is a rapid accumulation of plant material in those lakes — mosses, algae, other water plants — and leaf litter appears to be decomposing more slowly. If these trends are true, these lakes will become filled in with plant matter very rapidly."

Hendrey is now also investigating Golden Lake in the high peaks region of the Adirondacks. "It was surveyed in the 1930s, and no sphagnum moss was found in the lake. Today," he says, "all shallow portions — up to three feet deep — are completely covered with moss, and the moss is accumulating and not being removed by animals or bacteria, because those creatures have been removed by the acid. Many species of insects, invertebrates, snails are all gone; freshwater clams, many species of benthic zooplankton, mayflies, and stoneflies are gone," he says.

In Brookhaven's studies to determine which sections of the U.S. could be sensitive to acid rain, he has words of general cheer for the Midwest. "There isn't a whole lot that will happen in the Midwest, and acid rain isn't likely to affect the fresh waters [a great deal]." Why not? "Because the Midwest is formed primarily of bedrock that contains more limestone than is found in the Northeast or the Canadian shield."

But we in the Midwest dare not consider ourselves too lucky, for he suggests that it is most likely our air pollution that is creating some of the acid rain problem for other parts of the country and the world.

"Emissions in the form of sulfur dioxide," which come primarily from smelters and coal- and oil-fired power plants, begin in the Midwest and are transported out of the area before sulfur dioxides become sulfates and sulfuric acid, which are what really cause the damage. By the time this polluted air gets to New England, Hendrey says, "it has been mostly converted." Big emission regions, he points out, exist along the Ohio River and along the heavily industrialized cities that outline the Great Lakes — Milwaukee and Chicago, Gary and Detroit, Cleveland and Erie, and from the large steel mills in Indiana, Ohio, and Pennsylvania.

What can the average person do about acid rain?

"Become aware of the problem," Hendrey suggests. "Realize that acid rain is a product of our industrial society, and that the damage it causes is a real cost to us all. We don't see it easily," he says, but in addition to the measurable changes in bodies of water and upon plants and forests and creatures that inhabit them, acid rain exacts another cost.

"Acid rain makes our material, manmade possessions last a shorter time. It corrodes buildings, weakens nylon, rusts automobiles."

In the presence of acid precipitation, IJC's Science Advisory Board observes, calcium and magnesium are released more readily from soils, which can affect soil fertility. "Low pH levels also reduce the rate at which cellulose in plant tissues is decomposed, [and] changes in plant communities eventually will affect the Great Lakes," reports the IJC.

In addition, the Science Advisory Board warns, "the hydrogen ions in acid rain may trigger the release of toxic heavy metals such as mercury and lead, which would otherwise remain bound to soils and lake bottom sediments. The released metals can affect fish and other aquatic life. Further, metals are generally more toxic in more acidic waters. Some of the streams and rivers entering the Great Lakes have become more acidic and carry high concentrations of heavy metals. Fish species using these areas for spawning or as nurseries could feel the effects.

"When the pH changes," the IJC report continues, "species inhabiting the water body change. As stress on the system increases, fewer species and decreasing numbers of those can survive. Below 4.5pH all fish are eliminated.

"People are affected indirectly as their recreation areas change. Fish species and plant life alter, and the soils lose fertility. Directly, copper and lead concentrations in drinking water may increase because acidic water is carried in metal pipes."

What then, can be done — after more people become better informed of the problems and the increasing worldwide threat of acid rain?

Hendrey suggests that people will need to be "willing to pay the real dollar loss to acid rain in a different way — on our electricity bills, for instance, and not on a degraded environment." It is possible, he proposes, "to insist on a higher level of cleanliness from utility companies — to burn cleaner coal, to clean coal before it is burned or after it has been burned, with smokestack scrubbers."

A newer technique known as fluidized-bed combustion processes offers hope, he says. This is a technique in which "limestone is injected into the burner of a power plant and essentially scavenges sulfur dioxide as it's formed, so that it removes the sulfur during the burning process and also reduces the temperature of combustion so that less nitrogen oxide is formed by this process." Some experimental work is being done with test boilers, Hendrey says, "but they are expensive."

Yet, he suggests further, it may be better — say nothing of fairer — "to pay that cost. Instead of ruining a tourist industry [such as the Adirondacks area] in New England, or paying a large cost in a small area, it may be better to pay a similarly large cost, but to spread it out over a large area."

The EPA has recently announced final rules for new coal-burning electric power plants. The new-plant rules are substantially more stringent than current standards and will permit greatly increased coal use without increasing national sulfur dioxide and particulate — dust, smoke, and fly ash — emissions.

In effect, the new rules will require sulfur dioxide removal devices called scrubbers on all 350 new power plants expected to be built in the U.S. between now and 1995.

The EPA estimates that the new standard will increase the average monthly residential electric bill in 1995 by about 2 percent over the current standard. The new regulations also contain provisions that encourage development of other new control technologies for power plants. For instance, if it is found that an emerging technology cannot achieve the new standards but offers superior environmental performance, alternative standards could in the future be established by EPA. —*Susan Nelson,* EPA Environment Midwest.

### West Chicago Prairie Acquired for Public Use

The 153-acre West Chicago Prairie, one of the largest natural areas in suburban Chicago, has been purchased by the Nature Conservancy, a national nonprofit conservation organization. Located in DuPage County, 35 miles due west of Chicago in the City of West Chicago, the West Chicago Prairie contains four natural ecosystems: marsh, savannah, and two types of prairie. Three hundred fifty plants, more than 40 percent of all species native to DuPage County, have been found within the borders of this unique natural area, including the federally threatened white lady's slipper orchid (*Cypripedium candidum*)—on the U.S. list of threatened species and *Carex crawei*, an Illinois endangered species. An excellent wildlife habitat, West Chicago Prairie is home to the vanishing Massasauga rattlesnake and the state-endangered marsh hawk, as well as a variety of ground-nesting birds, deer and raccoon. Originally zoned industrial, and slated as part of the *WESCOM* industrial park, West Chicago Prairie contains 12.8 percent of all remaining prairie of its type in the state of Illinois.

The Nature Conservancy, which acquired the suburban land valued at $1,530,000, is holding the property for resale to the City of West Chicago and the DuPage County Forest Preserve District. These two bodies will purchase the land from the Conservancy with a grant from the federal Land and Water Conservation Fund, the local matching acquisition dollars. The Prairie will be dedicated as a state nature preserve and be managed by the DuPage County Forest Preserve District. The area will be open to the public for research, environmental education, and passive recreation.

### Rain Brings Baby Crane

Ornithologists had to create artificial rain every day for months, but finally got two rare birds to feel at home, become amorous, and mate, yielding a scientific first over the weekend.

A Brolga crane, first ever to hatch outside the species' native Australia, came out of its shell at the International Crane Foundation headquarters near Baraboo, Wis.

Australian aborigines call the cranes Brolgas, or dancing cranes, because of an elaborate courtship dance they perform during the monsoon season.

Scientists at the crane foundation speculated it was the lack of a Wisconsin monsoon season that kept Olga, the mother of the chick hatched over the weekend, from laying a single egg for five years after she was brought here.

So Kate Lindsey, a student ornithologist at the foundation, came up with the idea of sprinkling Olga and her mate, Willie, with water for two hours a day. The birds eventually began their mating calls and courtship dance and an egg soon appeared.

Brolga cranes stand 4½ feet tall as adults. The silver gray chick, 5 inches tall, was named Lindsey, after Lindsey.

### Owls Enlisted for Rodent Control

Two New Jersey cities, Morristown and Bloomfield, have substituted owls for poison in their rodent control programs. Adult owls can eliminate up to 35 rats and mice each day. Although barn owls are native to the state, they had abandoned the area when roosting places became scarce and their food supply poisoned. Reintroduced fledglings have been provided with nesting boxes and a renovated barn to call home, and all poisoning has been stopped. No concrete results yet.

### Piranha in Florida Waters

Beneath the surface of Florida's inviting freshwater lakes and streams, authorities fear, may lurk a growing number of piranha — schools of which can strip a human to bone in minutes.

So far, only single specimens of the vicious South American carnivores have been reported in Florida waters. But those reports have prompted Florida's Game and Fresh Water Fish Commission to raise its guard.

"We know now that piranha could survive and reproduce in the wild in all of southern Florida as far north as Daytona," said Paul Shafland, director of the commission's non-native fish research laboratory in Boca Raton.

The commission last month arrested two men accused of importing 735 of the illegal fish, which officials think may have been intended for the state's piranha black market.

"There is definitely a black market in piranha," said James A. McCann, director of the national fisheries research laboratory of the U.S. Fish and Wildlife Service in Gainesville.

"People have always been fascinated by man-eaters," Shafland said. "The attraction is that people like to have something that nobody else has."

Florida Atlantic University biology professor Walter Courtney estimates there are "many hundreds, possibly thousands" of illegal piranha in private aquariums all over the state.

Courtney says the ban on piranha — and the subsequent black market price of as much as $50 each — is intended to discourage persons who own them from dropping the carnivorous fish into a stream when they outgrow their aquariums.

Even so, at least some piranha have gotten into the wild. In April, a 12-inch red piranha was caught in a Boca Raton pond by a fisherman.

### New Light on Skunk Scent

Although everyone knows that the skunk, when sufficiently provoked, can produce an odor that will make even strong men (or women) beat a hasty retreat, scientists recently have detailed the noxious chemicals in the offensive emission that do the trick.

At the turn of the century, scientists believed that the defensive scent of the North American striped skunk (*Mephitis mephitis*) consisted, partially at least, of 1 butanethiol, confirming earlier work that had shown the scent to contain sulfur. By the mid-1940s, it was reported that besides thiols, the skunk scent contained crotyl sulfide, an equally unpleasant smelling compound.

Now two chemists from the University of New Hampshire, Durham, Kenneth K. Andersen and David T. Bernstein, have pinned down chemical constituents of the striped offender's weapon. Andersen and Bernstein took up the banner of skunk scent research as a result of some initial interest in insect pheromones. Unfortunately, the necessary insects for the work weren't available, so they decided to work with something that was—the skunk. The skunk scent needed for the research was plentifully available from a skunk farm in Massachusetts where the animals are raised—and descented—for sale as household pets.

The chemists obtained the scent for their analytical work by withdrawing samples from live male and female skunks with a syringe. The fluid was combined and partitioned in a separatory funnel into two layers, one organic and one aqueous. Distillation of the organic layer under vacuum yielded the volatile "evil smelling part of the scent."

Subsequent analysis of the distillate by gas chromatography produced three major constituents, whose identities were confirmed with infrared and nuclear magnetic resonance spectrometry. Found in a ratio of 4:3:3 were *trans*-2-butene-1-thiol, 3-methyl-1-butanethiol, and methyl-1-(*trans*-2-butenyl) disulfide. Absent, according to the New Hampshire scientists, were the earlier reported 1-butanethiol and dicrotyl sulfide.

So far the only interest in the work, says Andersen, has come from two veterinarians he knows who are interested in a method of deodorizing dogs that have antagonized roaming skunks into leveling a blast at them. It probably can be safely assumed that a major new industry based on this work won't be developing in the near future.

*Chemical Engineering News*

# Field Museum Tours

### Archaeological Tour of Egypt with Nile River Cruise Jan. 31-Feb. 17, 1980

Field Museum once again presents its popular Egypt tour with a Nile River cruise. This is the fourteenth such tour offered to Members during the last four years. The new and improved programs offers an 11-day Nile cruise on our own chartered, private, modern Nile steamer. In addition, we will be visiting Cairo, Memphis, Sakkara, Aswan/Abu Simbel, Edfu, Esna, Kom Ombo, Luxor, Thebes, Valley of the Kings and Queens, Dendereh, Abydos, Amarna, Middle Kingdom Tombs at Beni Hasan, Pyramid at Medum, and much more.

Eighteen days exploring Egypt with our Egyptologist, Mrs. Del Nord, a doctoral candidate at the Oriental Institute of the University of Chicago, who has traveled extensively in Egypt. Leave Chicago on January 31, 1980, and return on February 17. Price includes all air transportation, meals, Niles cruise, hotels, tips, taxes, transfers, visa fees, admissions, baggage handling, escorts, and more. $3,595.00 per person based upon double occupancy. The tour price includes a $500.00 contribution to the Field Museum. A $500.00 per person deposit is required for reservation confirmation. The group is limited to 30 persons. Single supplement is available upon request, Nile cruise and land.

### Kenya Safari Feb. 13-March 5, 1980

The wildlife of Kenya, both plant and animal, will be the focal point of this exciting 22-day tour of Kenya. An added bonus will be one of nature's most spectacular phenomena, a total eclipse of the sun which will occur on Feb. 16, 1980, and which you will view from the vantage point, the Taita Hills. On the tour you will visit Nairobi, Amboseli beneath Mt. Kilimanjaro, Tsavo West, Tsavo East, Mombasa on the Indian Ocean, the Ark, Samburu, Mt. Kenya Safari Club, Lake Naivasha, Masai Mara adjoining the Serengeti, and more.

The tour will be led by Dr. Robert Faden, assistant curator of botany, and his wife, Audrey Joy Faden. Dr. Faden lived in Kenya for more than seven years and is very well versed in the flora. Audrey Faden, a wildlife artist, was born and raised in Kenya and has a firsthand knowledge of the fauna.

The tour leaves Chicago on Feb. 13, 1980, and returns March 5. Price includes all air transportation, meals, transportations within Kenya, hotels, tips, taxes, visas, transfers, baggage handling, admissions, escorts, and more. The tour cost is $4,575.00 per person based upon double occupancy from Chicago; this includes a $500.00 contribution to Field Museum. A $750.00 deposit per person is required for reservation confirmation. The group is limited to 25 persons. Single supplement is available upon request.

### Antarctica, Jan 6-30, 1980

Until recently, only explorers were able to view Antarctica's wondrous beauty. There is no destination more remote, more unspoiled by the encroachments of civilization. Our itinerary includes the Falkland Islands, a visit to the Patagonian coast, the South Georgia Islands, the South Orkney Islands, and of course, Antarctica. Dr. Edward Olsen, curator of mineralogy, will be tour lecturer.

The cruise vessel will be the 3,200-ton ship, *M.S. World Discoverer*, registered in Hong Kong, which will take us from Punta Arenas, Argentina, onwards. Built in 1974, the one-class vessel has all outside cabins with private lavatories and showers. The ship's staff includes a fully qualified physician. The tour leaves Chicago Jan. 6, 1980 and returns Jan. 30. Prices per person: C deck twin: $3,230; C deck single: $4,870; B deck twin: $3,570; B deck single: $5,390; A deck twin: $3,930. Air fare, in addition is $1,225 (round trip between Chicago and Punta Arenas, Argentina). Included in the tour price is a tax-deductible donation of $500.00 to Field Museum. Deposit required at time of registration: $1,000.00 per person.

### Geology Tour of England and Wales June 14—July 3, 1980

Highlights of this 20-day tour, under the leadership of Dr. Bertram Woodland, Field Museum's curator of petrology (and a native of Wales), will be visits to classical areas of British geology where many fundamental aspects of geology were first discovered. The geological history and scenic development of these areas will be emphasized. Included in the tour are visits to the South Coast, West Country Cotswolds, Welsh Borderlands, North Wales, Lake District, Yorkshire Dales, and the Peak District. The group is limited to 25 persons.

Cost of the tour—$2,640 (which includes a $300 donation to Field Museum)—is based upon double occupancy and includes round trip air fare between Chicago and London. First class accommodations will be used throughout. The package includes breakfast and dinner daily, chartered motorcoach, baggage handling, all transfers, taxes (except airport tax), and tips (except to tour guides), all sightseeing charges and admissions to special events. Advance deposit: $250.00 per person.

### Natural History Tour of Hawaii March 9-22, 1980

The islands of Kauai, Maui, Hawaii and Oahu will be visited on this 14-day tour of the archipelago state. Highlights of the tour will be discussion of the natural history of the islands — their volcanic origin; their evolution from young high islands to atolls to submarine seamounts; and the sources of the distinctive flora and fauna, both terrestrial and marine. Also to be discussed is the impact of human activity on the indigenous flora and fauna, including ruinous habitat alterations, and the effects of broad-scale introduction of exotic species. Tour members will have the chance to see first-hand many of the geological, botanical and zoological objects under discussion. The group, limited to 30 persons, will be led by Dr. Robert K. Johnson, associate curator and head, Division of Fishes, Field Museum; and by Dr. John Fay, botanist with the U.S. Department of Interior's Office of Endangered Species.

The tour cost — $2,437 (which includes a $300 donation to Field Museum) — is based upon double occupancy and includes round trip air fare between Chicago and Honolulu and all inter-island flights. Deluxe accommodations will be used throughout. The package includes breakfast and dinner daily plus three lunches, lei greeting and cocktail receptions, baggage handling, all tips, taxes, and transfers, all sightseeing charges and admissions to special events. Advance deposit: $250.00 per person.

*For additional information and reservations for all tours, call or write Field Museum Tours, Roosevelt Rd. at Lake Shore Dr., Chicago, Ill. 60605. Phone: (312) 922-9410, X-251.*

# November & December at Field Museum

November 15 through December 15

### New Exhibits

**"Image and Life: 50,000 Years of Japanese Prehistory."** Opening December 1. Ceramics, stone tools, figurines, and bronze weapons, and ornaments representing the Paleolithic, Jomon, Yayoi, and Kofun periods of Japanese history are included. Ages of artifacts range from about 50,000 years ago to the 3rd century A.D. Hall 27. For additional information see p. 4.

**"The Place for Wonder."** Find out about the new feature in "The People Center": "touchable" items from the People's Republic of China. You can try on a jacket worn by villagers, or one worn by city dwellers. Other touchable items include Chinese newspapers and magazines, a fortune-telling book, and a bamboo purse.

All of this and more is available in the Place for Wonder, the ground floor gallery where children and adults alike may handle what they see. The exhibits include examples from the Museum's four disciplines: geology, botany, zoology, and anthropology. The exhibit is also equipped with text in braille. Weekdays 1:00-3:00 p.m., weekends 10:00 a.m. to noon and 1:00-3:00 p.m.

### Continuing Exhibits

**"Art Lacquer of Japan."** The Museum's newest permanent exhibit features more than 400 objects of exquisite lacquer art from 18th- and 19th-century Japan. The objects on display include finely carved and decorated *inro* (small sectional lacquer cases used to carry medicine), *ojime* beads, and *netsuke* (miniature carved pendants hung from silk cords). These objects were worn by Japanese men as symbols of wealth and status. Hall 32, second floor.

**"A Stamp Sampler: Postage from Natural History."** A one-case exhibit that combines 63 natural history specimens with samples of philatelic, or stamp, art. Planned on a rotating basis to cover the four disciplines of natural history, the exhibit in its first phase is devoted to zoological specimens and their images on stamps. Exquisite seashells, butterflies, a leaping jaguar, and fox are among the specimens mounted in the second floor lounge. "A Stamp Sampler" was conceived by Col. M. E. Rada, exhibit guest curator, and designed by Peter Ho, a University of Illinois graduate student.

**"Hall of Chinese Jades."** The Hall of Chinese Jades contains examples of beautiful jade art spanning over 6,000 years of Chinese history. An exhibit in the center of the hall illustrates ancient jade-carving techniques. Hall 30, second floor.

### New Programs

**"Festival of Anthropology on Film."** More than 60 ethnographic films examine the incredible diversity of peoples around the world. In addition to the main culture films in James Simpson Theatre and A. Montgomery Ward Hall, there will be continuous screenings in Lecture Hall II of subject films on men and women, music, drama, technology, ecology, and humor, irony, and parody. The Festival will feature documentary classics such as Napolean Chagnon's "Magical Death," Jean Rouch's "Jaguar," as well as selections from Field Museum's own film archives. Nov. 30 (5 p.m. - 9 p.m.), Dec. 1 and 2 (11 a.m. - 5 p.m.). Admission: Members one day $4.00, series $10.00; nonmembers one day $5.00, series $13.00. For further information see pages 18-21.

**"Image and Life: 50,000 Years of Japanese Prehistory."** Lecture by Ellen J. Zak, Coordinator of Education Programs, Center for Japanese Studies, University of Michigan. Friday, Dec. 7, 8 p.m. Members $2.00, nonmembers $3.50. James Simpson Theatre, West Door.

**"The Jomon Period."** Free 48-min. film, 11:00 a.m. and 2:00 p.m. Fridays in December. Lecture Hall I.

**Weekend Discovery Programs.** Free guided tours, demonstrations, and films. Check Weekend Sheet available at North Information Booth for additional programs and locations.

"China Through the Ages." A look at traditional China through rare turn-of-the-century lantern slides. Saturday, Nov. 17, at 12 noon.

"Olympic Rain Forest." This 20-minute film studies the vegetation and animal life of a rain forest, and shows climatic reasons for its existence. "Cave Ecology." 13-minute film showing how the cave—a small, simple, enclosed system—is an ideal place to study the biological principles that govern a living community. Saturday, Nov. 17, at 1:00 p.m.

"Indians of North America." This tour explores the daily life of six Indian tribes, from the Iroquois in the north to the Hopi in the Southwest. Saturday, Nov. 17, at 2:30 p.m.

"The Northwest Coast: Costume and Finery." 45-minute slide presentation shows how native and imported materials were used in Northwest Coast apparel to display wealth and social status. Sunday, Nov. 18, at 2:00 p.m.

"Ancient Ocean Environments." 1/2-hour tour and movie focus

*(Continued on back cover)*

# For Christmas Give Field Museum

*Whether you are trying to decide on a Christmas gift for the small child or for "the man who has everything," a gift of Membership in Field Museum is always appropriate.*

*For the adult, a Membership can provide a wealth of opportunities to further explore the realm of natural history; for the child it can open the doors to a lifetime of scientific interest or professional endeavor. Infinitely more than a storehouse of fascinating specimens and exhibits, Field Museum offers to its Members at every age level a varied selection of exciting learning experiences via the classroom, workshop, laboratory, film lecture, or field trip.*

*Perhaps equally important: with a Field Museum Membership you are giving a shared relationship, for Field Museum is indeed its Members.*

**clip and mail this coupon or facsimile**

to: Membership Department
Field Museum of Natural History
Roosevelt Road at Lake Shore Drive
Chicago, Il 60605

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☐ Check enclosed payable to Field Museum
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☐ Send gift card announcement in my name

# November & December at Field Museum

November 15 through December 15

*(Continued from p. 26)*

on the underwater world of ancient invertebrates, some of whose successors are alive today. Saturday, Dec. 1, at 1:30 p.m.

"The Vanishing Race." 1/2-hour slide presentation of E.S. Curtis's photographs showing early 20th-century Indian life in North America. Sunday, Dec. 2, at 1:30 p.m.

"Indian Fishermen of the Northwest Coast." The everyday as well as ceremonial life of Northwest Coast Indians centered around their fish harvests. This 45-minute tour illustrates the importance of fish in story and art and also examines Northwest Coast fishing techniques. Saturday, Dec. 8, at 12:20 p.m.

"Bitter Melons." This 30-minute film, made on the Harvard-Peabody Museum expedition to Botswana in 1955, focuses on the Bushman's search for subsistence in a harsh desert environment. The soundtrack for the movie is provided by blind songmaker Ukxone. Saturday, Dec. 8, at 1:00 p.m.

"Northwest Coast Costume and Finery." 45-minute slide presentation shows how local and traded materials were used in Northwest Coast apparel to display wealth and social status. Sunday, Dec. 9, at 2:00 p.m.

"The Turtle People." This 25-minute film documents how the Miskito Indians of the eastern coast of Nicaragua have entered the modern economic market by their pursuit of the turtle. Although a staple in their diet for over 350 years, the turtle is now hunted for money rather than food. Saturdays, Dec. 15, at 1:00 p.m.

"Ancient Ocean Environments." 1/2-hour tour and short movie focus on the underwater world of ancient invertebrates, some of whose successors are alive today. Saturday, Dec. 15, at 2:00 p.m.

**Edward E. Ayer Film Lectures** are scheduled on Saturdays through November, at 2:30 p.m., James Simpson Theatre. Reserved seating is available for Members and their families. Doors open at 1:45 p.m.

Nov. 17 "Yugoslavia," by Gene Wianko
Nov. 24 "Hong Kong and Macau," by F. Reidelburger

**Fall Journey: "Creatures of the Night."** Until December 1. Self-guiding tour takes you to another world—a world of darkness. Many forms of North American wildlife are nocturnal. Although numerous, they are hidden by the darkness of night. Learn how these "invisible" animals live and thrive—as creatures of the night. Free *Journey* pamphlets available at the North Information Booth and at the South and West Doors.

### Continuing Programs

**"The Ancient Art of Weaving."** Learn about age-old weaving techniques and textile development during these free demonstrations. Monday, Wednesday, and Friday from 10:00 a.m. to noon. South Lounge, second floor.

**Friend or Foe? The Natural History Game.** The object here is to determine which one of a pair of apparently similar specimens is harmful and which is not. See if you can distinguish a vampire bat, a headhunter's axe, a poisonous mineral, or a deadly mushroom from its benign look-alike. Ground floor, no closing date.

**On Your Own at Field Museum.** Self-guided tour booklets, adult-and-family-oriented, are available for 25¢ each at the entrance to the Museum Shop, main floor north.

**Volunteer Opportunities.** Limited opportunities available in botany, geology, and zoology. Weekend volunteers with an interest in natural history are needed to develop and present weekend programs. For more information call 922-9410, ext. 360.

**November and December Hours.** The Museum is open from 9 a.m. to 4 p.m., Monday - Thursday; 9 a.m. to 5 p.m., Saturday and Sunday; and 9 a.m. to 9 p.m., Friday.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at the reception desk, main floor. Closed Thanksgiving, Nov. 22.

December
1979

# FIELD MUSEUM OF NATURAL HISTORY BULLETIN

# Field Museum of Natural History Bulletin

December 1979
Vol. 50, No. 11

*Editor/Designer:* David M. Walsten
*Production:* Martha Poulter
*Calendar:* Mary Cassai
*Staff Photographer:* Ron Testa



## Field Museum of Natural History

Founded 1893

*President and Director:* E. Leland Webber

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Features photos of the year's major exhibitions

back cover **December and January at Field Museum**
Calendar of coming events


*COVER*

*This ritual wine container, made of bronze and ornamented with lotus petals and a crane, will be on view August 20 through October 29, 1980, as part of* The Great Bronze Age of China: An Exhibition from the People's Republic of China. *More than 100 pieces, many of them just recently excavated and never publicly seen prior to this tour, will be on view. Excavated in 1923 at Xin-zheng, Henan province, the wine container was made between the mid-7th and mid-5th century B.C. Height 118 cm (46 7/16 in.). Photo by Seth Joel; courtesy The Metropolitan Museum of Art.*

## Dorothy S. Roder Heads Tours Program

Dorothy S. Roder, formerly head of the Membership Division, has been chosen to direct Field Museum's greatly expanded tours program. Mrs. Roder's 18 years' experience with the Membership Department and her necessarily close involvement with past tour activities qualify her eminently for the new post. As head of the tour office, Mrs. Roder succeeds Michael J. Flynn.

Highlights of the Museum's international tour program for 1980 include Antarctica (January 6-30), Egypt (January 31-February 17), Kenya (February 13-March 5), Hawaii (March 9-22), England and Wales (June 14-July 3), and China (May 11-30). For additional tour information, write or call Mrs. Roder at Field Museum Tours, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605. Phone: (312) 922-9410.

# Major Exhibitions for 1980

## *TAPA CLOTH, COLOMBIAN GOLD, TREASURES OF ANCIENT CHINA*

### *"Patterns of Paradise"*

*Tapa,* or "bark cloth," is the little known but widespread art form of this exhibit, opening March 6 and scheduled to remain on view for three months. Some 200 artifacts, almost entirely from Field Museum's own collection and representing many cultures, will comprise the show. (Illustrations for the months of February and March in this calendar issue feature artifacts from "Patterns of Paradise.") Organized by John Terrell, associate curator of Oceanic archeology and ethnology, and by Anne Leonard, researcher, Department of Anthropology.

### *"Gold of El Dorado: The Heritage of Colombia"*

This exhibit—the largest and most comprehensive presentation of Colombian archeology ever seen outside Latin America—opens April 25 and closes July 5. The hundreds of objects on display were drawn primarily from the Museo del Oro, Bogota, Colombia. (Three of the objects are featured in this issue's illustrations for the months of April, May, and June.) The highly acclaimed traveling exhibition had its premier showing last year at the Royal Academy, London, where it was described as "the richest display of ancient treasure since Tutankhamun."

### *"The Great Bronze Age of China: An Exhibition from the People's Republic of China"*

This assemblage of 105 major bronzes, jades, and ceramic figurines will be on view from August 20 to October 29. The exhibit is being organized by the Metropolitan Museum of Art, in New York City. Like the very successful China archeology show that traveled to Toronto, Washington, and Kansas City in 1976, this one is comprised of finds from recent excavations. Prior to the tour none of the pieces have been seen in any western country. A selection of these extraordinary art works are featured on following pages for the months of July through December, as well as on this month's cover.

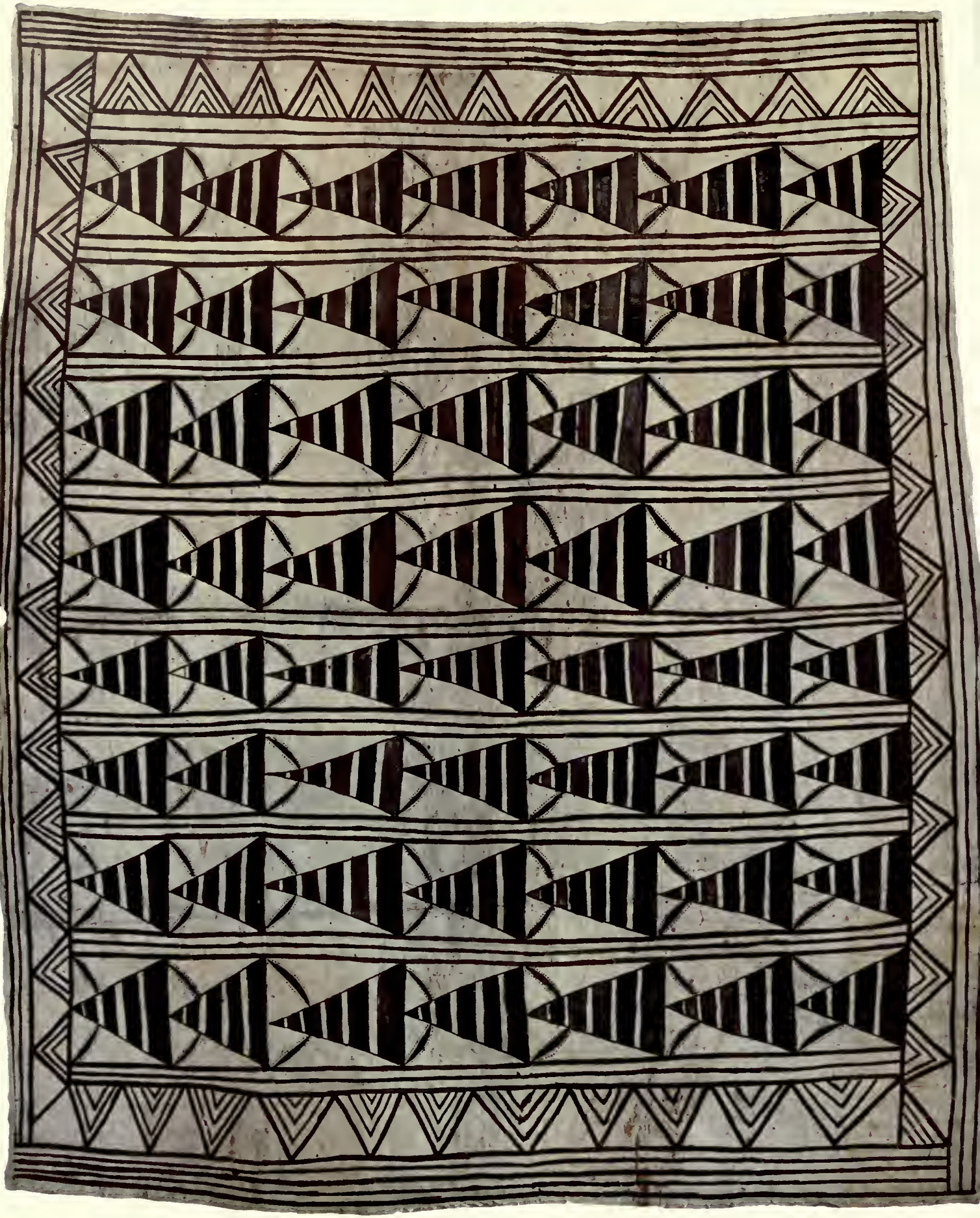
Courtesy Museum of Anthropology, University of British Columbia

*Japanese figurine of hollow clay, Kamegaoka style. Latest Jomon period (1000-300 B.C.), from Akita prefecture (northern Honshu). Height 22.3 cm (8 13/16 in.). From the collection of Tohoku University. Exhibit of prehistoric Japanese artifacts closes January 31.*

# January 1980

# *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| DECEMBER<br>S M T W T F S<br>1<br>2 3 4 5 6 7 8<br>9 10 11 12 13 14 15<br>16 17 18 19 20 21 22<br>23 24 25 26 27 28 29<br>30 31 | FEBRUARY<br>S M T W T F S<br>1 2<br>3 4 5 6 7 8 9<br>10 11 12 13 14 15 16<br>17 18 19 20 21 22 23<br>24 25 26 27 28 29 | 1 NEW YEAR'S DAY<br>Museum closed | 2<br>full moon | 3<br>*Earth at perihelion (closest to sun): 91.4 million miles* | 4<br>*Quadrantid meteor shower (100 per hour)* | 5<br>Discovery Programs every Saturday and Sunday |
| 6 | 7 | 8 | 9 | 10<br>last quarter | 11 | 12<br>Greg Thomas flint-knapping demonstration Hall 4 11 a.m., 2 p.m. |
| 13<br>Greg Thomas flint-knapping demonstration Hall 4 11 a.m., 2 p.m. | 14 | 15 | 16 | 17<br>new moon | 18 | 19 |
| 20 | 21 | 22 | 23 | 24<br>first quarter | 25 | 26 |
| 27 | 28 | 29<br>Register now for winter adult education courses | 30 | 31<br>**Japan Prehistory exhibit closes**<br>full moon | | |



Ron Testa

*Tapa cloth, Samoa; 170 x 215 cm. (67 x 85 in.). Catalog 39659.*

# February 1980

## *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| JANUARY<br>S M T W T F S<br>1 2 3 4 5<br>6 7 8 9 10 11 12<br>13 14 15 16 17 18 19<br>20 21 22 23 24 25 26<br>27 28 29 30 31 | MARCH<br>S M T W T F S<br>1<br>2 3 4 5 6 7 8<br>9 10 11 12 13 14 15<br>16 17 18 19 20 21 22<br>23 24 25 26 27 28 29<br>30 31 | | | | 1 | 2 Groundhog Day<br>Discovery Programs every Saturday and Sunday |
| 3 | 4 | 5 | 6 | 7 | 8<br>Learning Museums South Seas film festival | 9<br>Learning Museums South Seas film festival<br>*last quarter* |
| 10 | 11 | 12 Lincoln's Birthday<br>Winter adult educ. courses begin | 13<br>Winter adult educ. courses begin | 14 Valentine's Day<br>Winter adult educ. courses begin | 15 | 16<br>*new moon* *total eclipse of sun (not visible in U.S.)* |
| 17 | 18 President's Day*<br>Volunteer recruitment week for "Gold of El Dorado" Monday thru Friday | 19 Shrove Tuesday | 20 Ash Wednesday | 21 | 22 Washington's Birthday*<br>*first quarter* | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | *The observance of George Washington's birthday as a legal holiday on Feb. 22 began in 1796. In many states, however, his birthday is now celebrated on the 3rd Monday of February, designated Presidents' Day. |

*Kavat masks fashioned of bark, Baining, New Britain. Left: 71.1 cm. (28 in.) high; right: 63.5 cm. (25 in.). Catalog 137749, 137752.*

# March 1980

# *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| FEBRUARY<br>S M T W T F S<br>1 2<br>3 4 5 6 7 8 9<br>10 11 12 13 14 15 16<br>17 18 19 20 21 22 23<br>24 25 26 27 28 29 | APRIL<br>S M T W T F S<br>1 2 3 4 5<br>6 7 8 9 10 11 12<br>13 14 15 16 17 18 19<br>20 21 22 23 24 25 26<br>27 28 29 30 | | | | | 1<br>Ayer Film Lecture "Holy Lands" by C. Forbes Taylor 2:30 pm.<br>*full moon*<br>*penumbral eclipse of moon (in U.S. visible only in extreme N.E.)* |
| 2<br>Discovery Programs every Saturday and Sunday | 3 | 4 | 5<br>*tapa cloth exhibit "Patterns of Paradise" Members' preview* | 6<br>**tapa cloth exhibit "Patterns of Paradise" opens** | 7 | 8<br>Ayer Film Lecture "Exploring Darwin's Islands" by Quentin Keynes 2:30 p.m. |
| 9<br>*last quarter* | 10 | 11<br>Register now for Spring Adult Education Courses | 12 | 13 | 14 | 15<br>Ayer Film Lecture "Taiwan" by Ed Lark 2:30 p.m. |
| 16<br>*new moon* | 17<br>St. Patrick's Day | 18 | 19 | 20 | 21<br>"Royal Dancers and Musicians from the Kingdom of Bhutan" 8 p.m. | 22<br>Ayer Film Lecture "Portugal" by Frank Nichols, 2:30 p.m. |
| 23<br>*first quarter*<br>Palm Sunday 30 | 24<br>*full moon* 31 | 25 | 26 | 27 | 28 | 29<br>Ayer Film Lecture "Land and Sea Adventure" by William Sylvester 2:30 p.m. |

Lee Boltin for the American Museum of Natural History

*Tairona nose ornament, Colombia, made of cast gold. Worn by men and possibly by women. Width 6.6 cm (2⅝ in.). From Museo del Oro, Bogota.*

# April 1980

# *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| MARCH<br>S M T W T F S<br>1<br>2 3 4 5 6 7 8<br>9 10 11 12 13 14 15<br>16 17 18 19 20 21 22<br>23 24 25 26 27 28 29<br>30 31 | MAY<br>S M T W T F S<br>1 2 3<br>4 5 6 7 8 9 10<br>11 12 13 14 15 16 17<br>18 19 20 21 22 23 24<br>25 26 27 28 29 30 31 | 1 Passover | 2 | 3 | 4 Good Friday | 5<br>Ayer Film Lecture "Central America" by Jonathan Hayes 2:30 p.m. |
| 6 EASTER<br>Discovery Programs every Saturday and Sunday | 7 | 8 Register now for Kroc Environmental Field Trips<br>*last quarter* | 9 | 10 | 11 | 12<br>Ayer Film Lecture "Bavaria—Land of the Mountain King" by H. & L. Meyers 2:30 p.m. |
| 13 | 14<br>*new moon* | 15<br>Spring adult education courses begin | 16<br>Spring adult education courses begin | 17<br>Spring adult education courses begin | 18 | 19<br>Ayer Film Lecture "The Hawaiian Adventure" by Doug Jones. 2:30 p.m. |
| 20 | 21<br>*first quarter*<br>*Lyrid meteor shower (15 per hour)* | 22 | 23 | 24<br>*"Gold of El Dorado" Members' Preview* | 25 Kroc environmental film lecture "Colombia—the Andes to the Spanish Main" by George Lange 8 p.m.<br>**"Gold of El Dorado" exhibit opens** | 26<br>Ayer Film Lecture "The Majestic Rhine," by John Roberts, 2:30 p.m. |
| 27 | 28 | 29 | 30<br>*full moon* | | | |

Lee Boltin for the American Museum of Natural History

*Muisca dragon, Colombia, showing combination of goldworking techniques. Length 2.1 cm. (13/16 in.). From Museo del Oro, Bogota.*

# May 1980

# *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| APRIL<br>S M T W T F S<br>1 2 3 4 5<br>6 7 8 9 10 11 12<br>13 14 15 16 17 18 19<br>20 21 22 23 24 25 26<br>27 28 29 30 | JUNE<br>S M T W T F S<br>1 2 3 4 5 6 7<br>8 9 10 11 12 13 14<br>15 16 17 18 19 20 21<br>22 23 24 25 26 27 28<br>29 30 | | | 1<br>**MEMBERS' NIGHT** | 2<br>**MEMBERS' NIGHT** | 3<br>Discovery Programs every Saturday and Sunday |
| 4<br>*Eta Aquarid meteor shower (18 per hour)* | 5 | 6 | 7<br>*last quarter* | 8 | 9<br>"Gold of El Dorado" lecture 8 p.m. | 10<br>Kroc Environmental Field Trips begin |
| 11<br>Mother's Day<br>Kroc Environmental Field Trips begin | 12 | 13 | 14<br>*new moon* | 15 | 16<br>"Gold of El Dorado" lecture 8 p.m. | 17 |
| 18 | 19 | 20 | 21<br>*first quarter* | 22 | 23<br>"Gold of El Dorado" lecture 8 p.m. | 24 |
| 25 | 26<br>MEMORIAL DAY | 27<br>Register now for Summer Fun Workshops | 28 | 29<br>*full moon* | 30 | 31 |

Lee Boltin for the American Museum of Natural History

*Lime dippers (for extracting juice from flasks of lime), Colombia. Length (left): 30 cm (11¾); (right): 25.8 cm (10⅛ in.). Museo del Oro, Bogota.*

# June 1980

## *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| 1<br>Discovery Programs every Saturday and Sunday | 2<br>The Great Bronze Age of China Volunteer Recruitment Week Monday thru Friday | 3 | 4 | 5<br>*last quarter* | 6 | 7 |
| 8 | 9 | 10 | 11 | 12<br>*new moon*<br>*year's earliest sunrise (Central Standard Time): 4:06 a.m. (June 12, 13)* | 13 | 14<br>Flag Day |
| 15<br>Father's Day | 16 | 17<br>Summer Adult Education Courses Begin | 18<br>Summer Adult Education Courses Begin | 19<br>Summer Adult Education Courses Begin | 20<br>*first quarter* | 21<br>*year's latest sunset (Central Standard Time): 7:26 p.m. (June 21-28)* |
| 22 | 23 | 24 | 25 | 26 | 27 | 28<br>*full moon* |
| 29 | 30 | | | | | |

MAY

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| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 |

JULY

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| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | | |

Photo by Seth Joel; courtesy The Metropolitan Museum of Art

*Sacrificial basin, bronze, in form of tiger gnawing at tail of ox. Han dynasty (first half of 2nd century B.C.). Excavated in 1972 at Jiang-chuan, Yunnan province. Height 43 cm (16 15/16 in.).*

# July 1980

# *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| JUNE<br>S M T W T F S<br>1 2 3 4 5 6 7<br>8 9 10 11 12 13 14<br>15 16 17 18 19 20 21<br>22 23 24 25 26 27 28<br>29 30 | AUGUST<br>S M T W T F S<br>1 2<br>3 4 5 6 7 8 9<br>10 11 12 13 14 15 16<br>17 18 19 20 21 22 23<br>24 25 26 27 28 29 30<br>31 | 1 | 2 | 3 | 4 INDEPENDENCE DAY | 5 **"Gold of el Dorado" exhibit closes**<br>*last quarter*<br>*Earth at aphelion (furthest from sun): 94.5 million miles* |
| 6 | 7 Highlight Tours 1 p.m. | 8 Summer Fun Children's Workshops begin<br>Highlight Tours 1 p.m. | 9 Highlight Tours 1 p.m. | 10 Highlight Tours 1 p.m. | 11 | 12<br>*new moon* |
| 13 | 14 Highlight Tours 1 p.m. | 15 Highlight Tours 1 p.m. | 16 Highlight Tours 1 p.m. | 17 Highlight Tours 1 p.m. | 18 | 19 Discovery Programs every Saturday and Sunday |
| 20<br>*first quarter* | 21 Highlight Tours 1 p.m. | 22 Highlight Tours 1 p.m. | 23 Highlight Tours 1 p.m. | 24 Highlight Tours 1 p.m. | 25 | 26 |
| 27 *penumbral eclipse of moon (not visible in U.S.)*<br>*full moon* | 28 Highlight Tours 1 p.m. | 29 Highlight Tours 1 p.m. | 30 Highlight Tours 1 p.m.<br>*Delta Aquarid meteor shower (38 per hour)* | 31 Highlight Tours 1 p.m. | | |

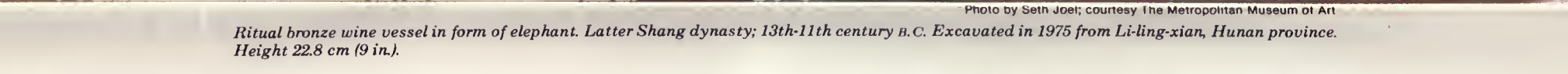

Photo by Seth Joel; courtesy The Metropolitan Museum of Art

*Ritual bronze wine vessel in form of elephant. Latter Shang dynasty; 13th-11th century B.C. Excavated in 1975 from Li-ling-xian, Hunan province. Height 22.8 cm (9 in.).*

# August 1980

# *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| JULY<br>S M T W T F S<br>6 7 8 9 10 11 12<br>13 14 15 16 17 18 19<br>20 21 22 23 24 25 26<br>27 28 29 30 31 | SEPTEMBER<br>S M T W T F S<br>1 2 3 4 5 6<br>7 8 9 10 11 12 13<br>14 15 16 17 18 19 20<br>21 22 23 24 25 26 27<br>28 29 30 | | | | 1 | 2<br>Discovery Programs every Saturday and Sunday |
| 3<br>*last quarter* | 4<br>Register now for Kroc Environmental Field Trips<br>Highlight Tours 1 p.m. | 5<br>Highlight Tours 1 p.m. | 6<br>Highlight Tours 1 p.m. | 7<br>Highlight Tours 1 p.m. | 8 | 9 |
| 10<br>*new moon*<br>*annular eclipse of sun (partial eclipse visible in S.E. U.S.)* | 11<br>Highlight Tours 1 p.m.<br>*Perseid meteor shower (65 per hour) Aug. 11-13* | 12<br>Highlight Tours 1 p.m. | 13<br>Highlight Tours 1 p.m. | 14<br>Highlight Tours 1 p.m. | 15 | 16 |
| 17 | 18<br>*"The Great Bronze Age of China" Members' preview*<br>*first quarter*<br>Highlight Tours 1 p.m. | 19<br>Highlight Tours 1 p.m.<br>*"The Great Bronze Age of China" Members' Preview* | 20<br>**"The Great Bronze Age of China" exhibit opens**<br>Highlight Tours 1 p.m. | 21<br>Highlight Tours 1 p.m. | 22 | 23 |
| 24<br>31 | 25<br>Highlight Tours 1 p.m.<br>*full moon*<br>*penumbral eclipse of moon (visible from most of U.S.)* | 26<br>Highlight Tours 1 p.m. | 27<br>Highlight Tours 1 p.m. | 28<br>Highlight Tours 1 p.m. | 29 | 30 |

Photo by Seth Joel, courtesy The Metropolitan Museum of Art

*Rhinoceros-shaped wine vessel, bronze, with cloud design in gold and silver inlay. Warring States period (475-221 B.C.). Excavated in 1963 from Xing-ping, Shanxi province. Height 34.1 cm (13⅜ in.).*

# September 1980

# *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| For information on volunteer opportunities at Field Museum call Volunteer Coordinator, 922-9410, ext. 360 | 1 LABOR DAY *last quarter* | 2 | 3 | 4 | 5 | 6 Kroc Environmental Field Trips begin |
| 7 Kroc Environmental Field Trips begin | 8 Register now for Fall Adult Education courses | 9 *new moon* | 10 | 11 Rosh Hashana | 12 The Great Bronze Age of China lecture 8 p.m. | 13 Discovery Programs every Saturday and Sunday |
| 14 | 15 | 16 | 17 *first quarter* | 18 | 19 | 20 YOM KIPPUR |
| 21 | 22 | 23 | 24 *full moon* | 25 | 26 American Indian Day The Great Bronze Age of China lecture 8 p.m. | 27 |
| 28 | 29 | 30 *last quarter* | | | | |

AUGUST

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
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| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | | | | | | |

OCTOBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 | 31 | |

Photo by Seth Joel; courtesy The Metropolitan Museum of Art



*Ritual wine vessel, bronze, Latter Shang dynasty, 13th-11th century B.C. Excavated in 1938 from Ning-xiang. Hunan province. Height 58.3 cm (23 in.).*

# October 1980

# *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| SEPTEMBER<br>S M T W T F S<br>1 2 3 4 5 6<br>7 8 9 10 11 12 13<br>14 15 16 17 18 19 20<br>21 22 23 24 25 26 27<br>28 29 30 | NOVEMBER<br>S M T W T F S<br>1<br>2 3 4 5 6 7 8<br>9 10 11 12 13 14 15<br>16 17 18 19 20 21 22<br>23 24 25 26 27 28 29<br>30 | | 1 | 2 | 3<br>The Great Bronze Age of China lecture 8 p.m. | 4<br>Ayer Film Lecture "England," by H. & L. Meyers, 2:30 p.m. |
| 5<br>Discovery Programs every Saturday and Sunday | 6 | 7 | 8<br>*new moon* | 9<br>*Draconid meteor shower (10 per hour)* | 10<br>The Great Bronze Age of China lecture 8 p.m. | 11<br>Ayer Film Lecture "The Great Smoky Mountains" by Richard Kern 2:30 p.m. |
| 12<br>Columbus Day (traditional) | 13<br>Columbus Day (observed) | 14<br>Fall Adult Education courses begin | 15<br>Fall Adult Education courses begin | 16<br>*first quarter*<br>Fall Adult Education courses begin | 17 | 18<br>Ayer Film Lecture "Charming Vienna" by A. de LaVarre, Jr. 2:30 p.m. |
| 19 | 20<br>*Orionid meteor shower (38 per hour)* | 21 | 22 | 23<br>*full moon* | 24<br>United Nations Day | 25<br>Ayer Film Lecture "Swiss on White" by John Jay 2:30 p.m. |
| 26 | 27 | 28 | 29<br>**"The Great Bronze Age of China" exhibit closes** | 30<br>*last quarter* | 31<br>Halloween | |

Photo by Seth Joel; courtesy The Metropolitan Museum of Art

*Terra-cotta striding infantryman. Qin dynasty (221-206 B.C.). Excavated in 1976 or 1977 at Lin tong, Shaanxi province. Collection of the Shaanxi Provincial Museum. Height 178 cm (70 in.).*

# November 1980

## *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| OCTOBER<br>S M T W T F S<br>1 2 3 4<br>5 6 7 8 9 10 11<br>12 13 14 15 16 17 18<br>19 20 21 22 23 24 25<br>26 27 28 29 30 31 | DECEMBER<br>S M T W T F S<br>1 2 3 4 5 6<br>7 8 9 10 11 12 13<br>14 15 16 17 18 19 20<br>21 22 23 24 25 26 27<br>28 29 30 31 | | | | | 1<br>Ayer Film Lecture "Sweden," by Dick Reddy; 2:30 p.m. |
| 2<br>Discovery Programs every Saturday and Sunday | 3 | 4 Election Day | 5 | 6 | 7<br>*new moon* | 8<br>Ayer Film Lecture "Greece" by Sherilyn & Matthew Mentes 2:00 p.m. |
| 9<br>*Taurid meteor shower (16 per hour)* | 10 | 11 Veterans Day (Armistice Day) | 12 | 13 | 14 | 15<br>Ayer Film Lecture "Paris" by Kathy Dusek; 2:30 p.m.<br>*first quarter* |
| 16<br>*Leonid meteor shower (15 per hour)* | 17 | 18 | 19 | 20 | 21 | 22<br>Ayer Film Lecture "Peoples of Romantic Europe," by W. Sylvester; 2:30 p.m.<br>*full moon* |
| 23 / 30 | 24 | 25<br>*Andromedid meteor shower (10 per hour) (Nov. 25-27)* | 26 | 27 THANKSGIVING | 28 | 29<br>Ayer Film Lecture "Ireland" by Robert Davis 2:30 p.m.<br>*last quarter* |

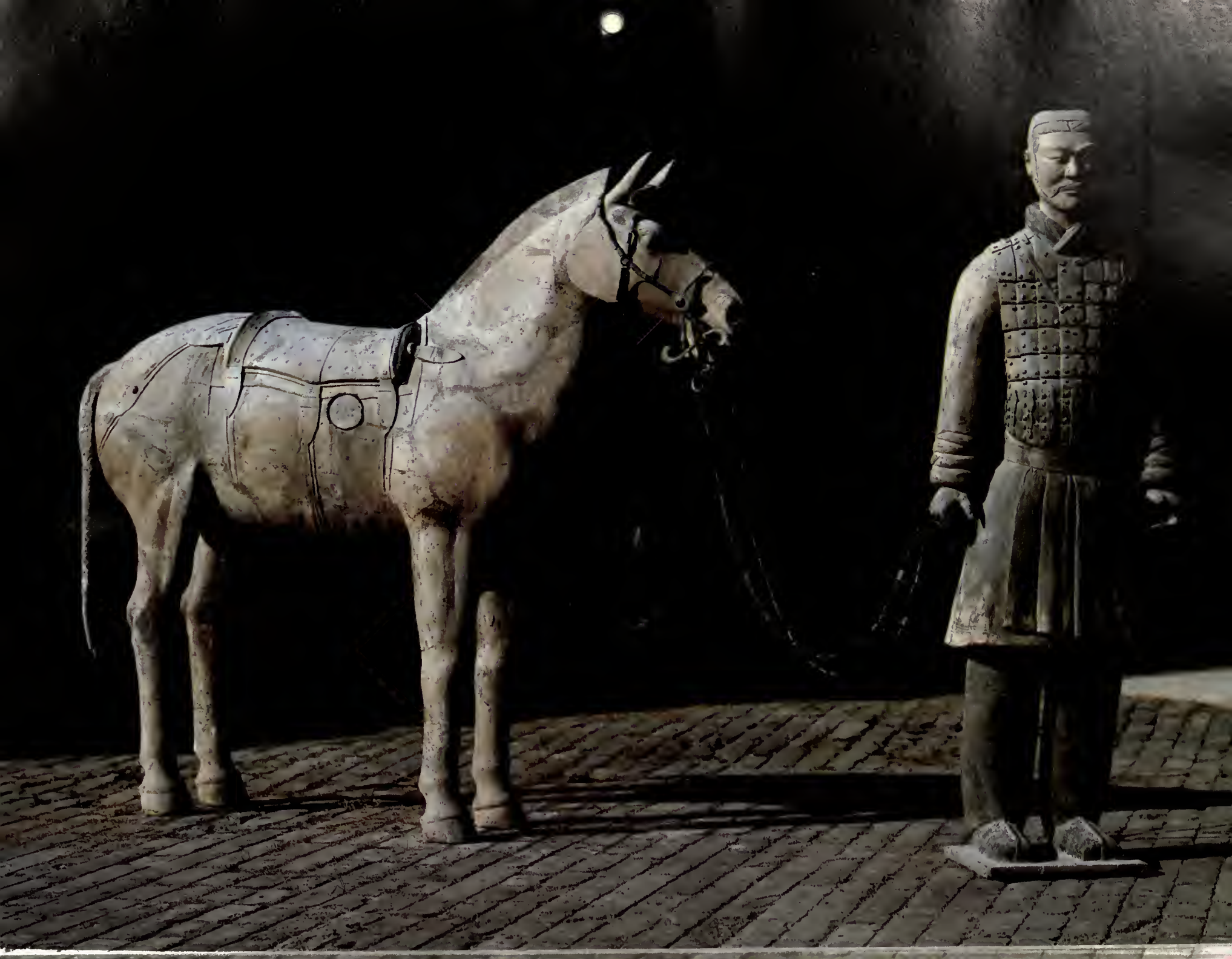

Photo by Seth Joel; courtesy The Metropolitan Museum of Art

*Terra-cotta cavalryman and saddlehorse. Qin dynasty (221-206 B.C.). Excavated in 1976 or 1977 at Lin tong, Shaanxi province. Collection of the Shaanxi Provincial Museum. Height of man 180 cm (71 in.); height of horse 172 cm (68 in.).*

# December 1980

## *Field Museum of Natural History*

| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 HANUKKAH | 4 | 5 3rd Annual Anthropology Film Festival | 6 3rd Annual Anthropology Film Festival |
| 7 3rd Annual Anthropology Film Festival *new moon* | 8 | 9 | 10 | 11 | 12 | 13 *Geminid meteor shower (55 per hour)* |
| 14 *first quarter* | 15 | 16 | 17 | 18 | 19 | 20 Discovery Programs every Saturday and Sunday |
| 21 *full moon* | 22 | 23 | 24 | 25 CHRISTMAS Museum Closed | 26 | 27 |
| 28 | 29 *last quarter* | 30 | 31 | | | |

NOVEMBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | | | 1 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | | | | | | |

JANUARY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 |

# December and January at Field Museum

*December 15 through January 15*

### New Exhibit

**"Image and Life: 50,000 Years of Japanese Prehistory."** Ceramics, stone tools, figurines, bronze weapons, and ornaments representing the Paleolithic, Jomon, Yayoi, and Kofun periods of Japanese history are included. Never before shown outside of Japan, these artifacts range in age from about 50,000 years old to the 3rd century A.D. Hall 27.

### Continuing Exhibits

**"The Place for Wonder."** "The People Center" features "touchable" items from the People's Republic of China. You can try on a jacket worn by villagers or one worn by city dwellers. Other touchable items include Chinese newspapers and magazines, a fortune-telling book, and a bamboo purse.

All of this and more is available in the *Place for Wonder,* the ground-floor gallery where children and adults alike may handle what they see. The exhibits include examples from the Museum's four disciplines: geology, botany, zoology, and anthropology. Exhibit labels are also provided in large type and braille for the visually handicapped. Weekdays 1:00–3:00 p.m., weekends 10:00 a.m. to noon and 1:00–3:00 p.m.

**"Art Lacquer of Japan."** The Museum's newest permanent exhibit features more than 400 objects of exquisite lacquer art from 18th- and 19th-century Japan. The objects on display include finely carved and decorated *inro* (small sectional lacquer cases used to carry medicine), *ojime* beads, and *netsuke* (miniature carved pendants hung from silk cords). These objects were worn by Japanese men as symbols of wealth and status. Hall 32, second floor.

### New Programs

**"Flint-knapping."** Flint-knapper Greg Thomas will demonstrate his art of making reproductions of primitive stone tools from chert and flint. Thomas, whose work has been exhibited in museums across the country, uses methods and tools like those of over 1,000 years ago. This free program will be held in Stanley Field Hall. Saturday and Sunday, Jan. 12 and 13, 11 a.m. and 2 p.m.

**Winter Journey:** "Whales—Mammals of the Deep." Self-guided tour examines the world of whales. Although these marine giants live in all the oceans, many species are dangerously close to extinction. Free *Journey* pamphlets are available at the North Information Booth and Museum entrances.

**Weekend Discovery Programs.** Free guided tours, demonstrations, and films. Weekend sheet available at North Information Booth lists additional programs and locations:

"The Turtle People." This film examines the changes that took place in the life of a Nicaraguan tribe when it began to hunt turtles for profit instead of food. Saturday, Dec. 15, 1 p.m.

"Ancient Ocean Environments." The underwater world of ancient invertebrates, some of whose successors flourish today, is the subject of this 1/2-hour tour and movie. Saturday, Dec. 15, 2 p.m.

"The Inside Story: Some Adaptations of Mammals' Bones and Teeth." This tour examines how skeletons provide clues to the life and habits of animals. Sunday, Dec. 16, 1 p.m.

"The Potato Planters." Bolivia's Aymara tribe is the topic of this film. Saturday, Dec. 22, 1 p.m.

"Museum Highlight Tour." Saturday, Dec. 22, 1:30 p.m.

"Whales—with Jacques Cousteau." The Cousteau expedition observes the behavior of several whale species in this 22-minute film. Saturday, Jan. 5, 2 p.m.

"China Through the Ages." This 30-minute tour and slide show looks at traditional China—its inventions, court life, and schools of thought. Saturday, Jan. 5, 1:30 p.m.

"The Vanishing Race." E.S. Curtis's photographs of early 20th-century Indian life are shown in this 30-minute slide presentation. Sunday, Jan. 6, 2 p.m.

"Ancient Egypt." The traditions of ancient Egypt, from every-day life to its myths and mummies, are explored in this 45-minute tour which meets at the North Information Booth. Saturday, Jan. 12, 11:30 a.m.

"Whales, Dolphins and Men." This 51-minute documentary considers the remarkable intelligence of dolphins and whales and also examines the whaling industry. Saturday, Jan. 12, 1 p.m.

"Clay Dinosaurs." Visitors may make model dinosaurs out of clay in the Hall of Fossil Vertebrates (Hall 38). Sunday, Jan. 13, 11 a.m. to 1 p.m.

### Continuing Programs

**"The Jomon Period."** Free 48-minute film shown in conjunction with the new exhibit "Image and Life: 50,000 years of Japanese Prehistory." 11 a.m. and 2 p.m. Fridays in December. Lecture Hall I.

**Friend or Foe? The Natural History Game.** The object here is to determine which one of a pair of apparently similar specimens is harmful and which is not. See if you can distinguish a vampire bat, a headhunter's axe, a poisonous mineral, or a deadly mushroom from its benign look-alike. Ground floor, no closing date.

**On Your Own at Field Museum.** Self-guided tour booklets, adult- and family-oriented, are available for 25¢ each at the entrance to the Museum Shop, main floor north.

**Volunteer Opportunities.** Volunteers with scientific interests and backgrounds are needed to work in the various departments. For more information call Volunteer Coordinator, 922-9410, ext. 360.

**December and January Hours.** The Museum is open 9 a.m. to 4 p.m., Monday through Thursday; 9 a.m. to 5 p.m., Saturday and Sunday; and 9 a.m. to 9 p.m., Friday. Closed Christmas and New Year's Day.

**The Museum Library** is open weekdays 9 a.m. to 4 p.m. Obtain a pass at the reception desk, main floor. Closed Monday and Tuesday, Dec. 24, 25; and Monday and Tuesday, December 31 and January 1.

Museum Telephone: (312) 922-9410